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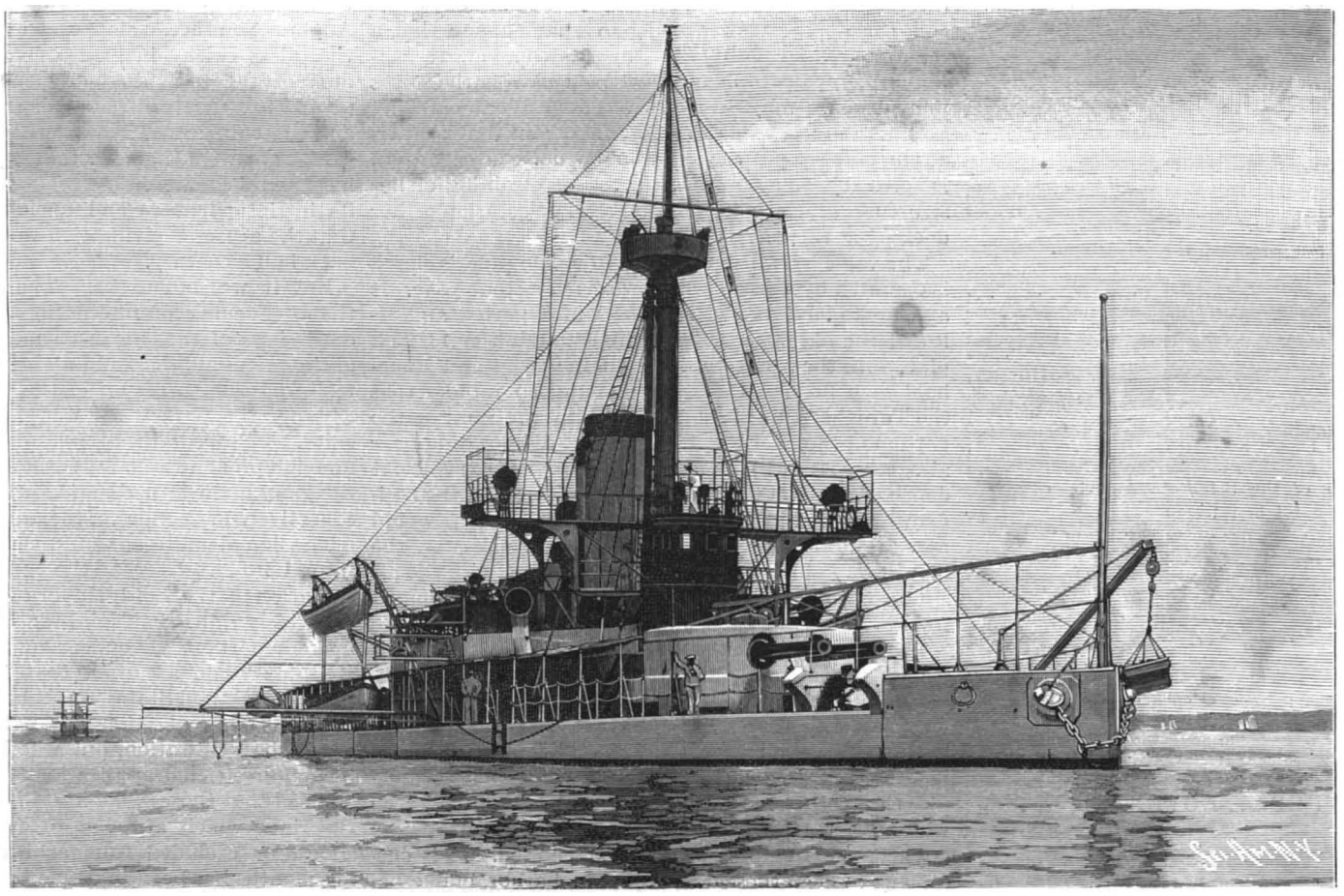
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THE COAST DEFENSE MONITOR AMPHITRITE.

The formidable little warship which forms the subject of the accompanying illustrations is one of a group of five similar vessels whose keels were laid as far back as the year 1874. In the official lists of the navy they are described as iron low freeboard coast defense monitors. With the exception of a few small gunboats, they represent the only new construction attempted in the navy during that long twenty years of silence which fell upon the busy navy yards of the country from the close of the civil war to the date of the construction of our modern navy. The building of even these

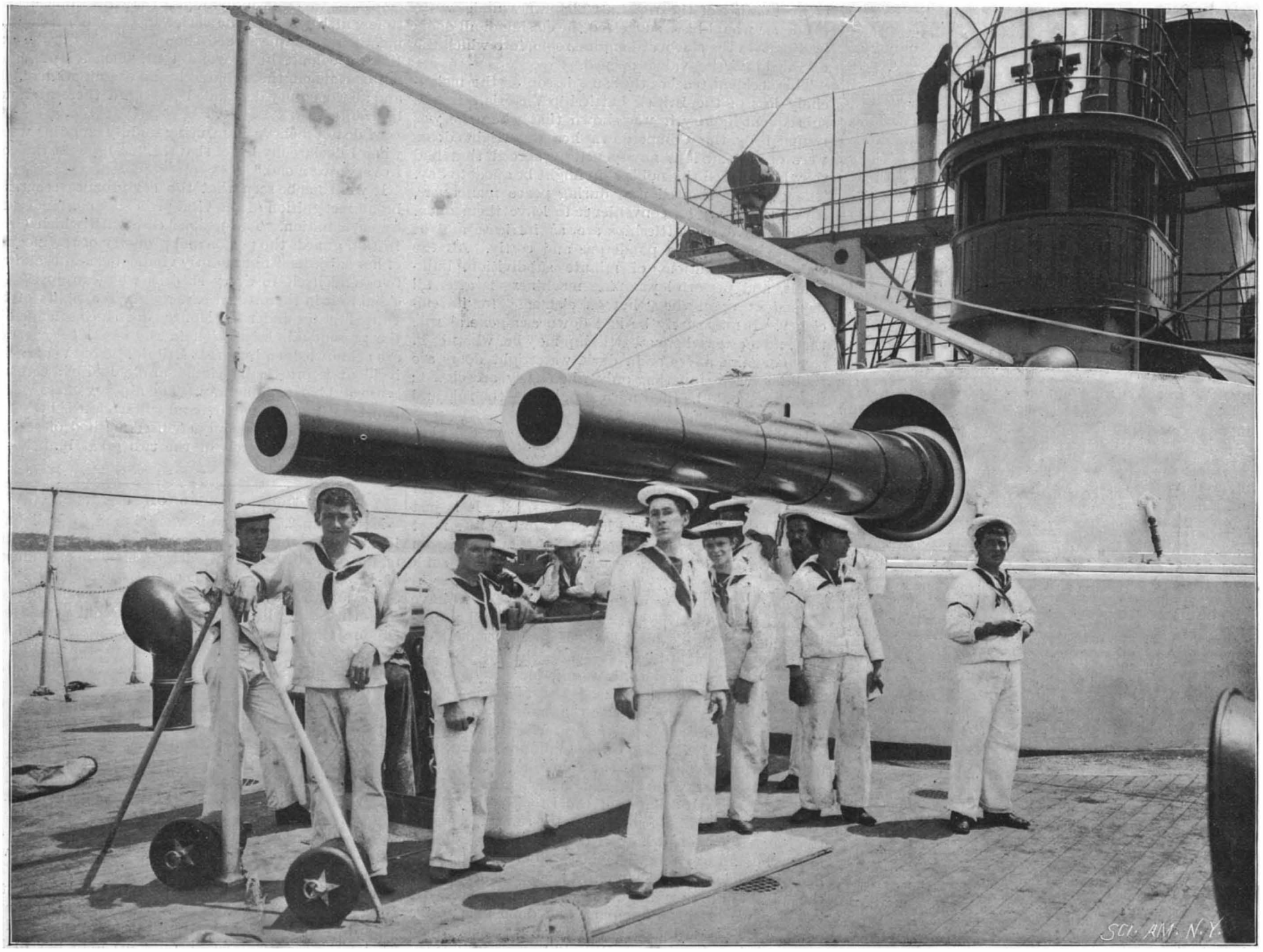


THE COAST DEFENSE MONITOR AMPHITRITE.

e ships was carried on slowly, and it was stopped before they were completed, and the shells of the ships, with their engines on board, but with armor or armament, were laid by, and it was not until March 3, 1895, that an appropriation of $3,-8,046 was made for their completion.

Of the five monitors, three, the Miantonomoh, Monadnock, and Terror, are sister ships to the Amphitrite, which is 3,990 tons displacement, the Puritan being considerably larger, 6,060 tons, and carrying 12 inch against the 10 inch guns of the small-

(Continued on page 381.)



COAST DEFENSE MONITOR AMPHITRITE—THE FORWARD PAIR OF TEN INCH GUNS.

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NEW YORK, SATURDAY, NOVEMBER 21, 1896.

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THE SINKING OF THE BATTLESHIP TEXAS.

That most unlucky of all the ships of our navy, the Texas, has added one more accident to the long list which lies to her credit by going to the bottom as she lay at her moorings at the Brooklyn Navy Yard last week.

As far as can be learned at this early stage of the inquiry, it looks as though the accident was due to an attempt to make repairs upon the ship's starboard injection valve while she was afloat. The injection valve controls the admission of sea water to the condensers, and is situated near the entrance of a pipe, which pierces the ship's bottom, and conducts water directly from the sea to the condensers. It appears that this apparatus was being overhauled, and that a temporary valve had been put in with a view to enabling the repairs to be made without placing the Texas in dry dock. Why this work was done afloat can only be surmised; but we can well understand that there is a reluctance to put the Texas in dry dock oftener than is necessary, on account of the serious straining of her structure which took place on the last occasion of her docking at this navy yard.

The valve by which the main injection pipe is closed is operated by a screw which works in a stout yoke. It appears to have been this yoke which parted and allowed the sea water to flow in through the 13 inch pipe, with the result that the engine room and stokehold were flooded, the water gaining so rapidly that the Texas sank until she rested upon the mud at the bottom of the East River. That she did not disappear altogether is due to the fact that there was not sufficient depth of water at this point to cover her; had the accident happened in deeper water, this battleship would now be out of sight, possibly for good. As it was, the divers were able to plug up the valve, and, with the assistance of a few wrecking tugs, the water was pumped from her hold and the ship floated.

The accident has created quite a sensation, and it is being freely asked what is the value of watertight compartments and the powerful pumping machinery of our warships if a paltry 13 inch hole can send them to the bottom in a sheltered navy yard. The accident happened in the early morning, and it will probably transpire that the watertight doors were open and that the water rose to the furnaces and put them out before any effective pumping could be attempted. It is customary to keep these doors open in harbor, and especially in dock, when repairs are under way, as a matter of convenience; but we think that in view of the very critical nature of the repairs which were under way, prudence would have suggested the closing of all doors leading into the starboard engine room, into which the disabled injection valves opened.

This accident teaches the same lesson as the melancholy loss of the British battleship Victoria. In the subsequent inquiry it was shown that when she was rammed by the Camperdown her watertight doors were open, and it is now generally agreed that had they been closed this noble ship might be afloat to-day. The evidence showed that during peace maneuvers, it was customary for convenience to leave them open.

These modern battleships are as intricate and as delicate as they are ponderous and costly. All the elaborate precautions of minute subdivision, bulkheads, and powerful pumping machinery is after all dependent upon the "human element" for its efficiency. It may surely be laid down as a general rule that, no matter where a battleship may be, whether in storm or calm, at sea or in dock, watertight doors are fulfilling their function only when they are closed; that this should be their normal position—the rule and not the exception.

Looked at in any light the mishap is a most deplorable occurrence, and coming as the crowning trouble in a long list of casualties it is liable to shake the confidence of the people at large in the Navy Department just at a time when it should be confirmed. It is just a piece of the sheerest good luck that one of the most costly ships in the navy is not now lying at the bottom of the sea, lost beyond recovery. Had the Texas sunk a few feet out in the river, or off Staten Island, or in any locality where the water was deep enough to have covered her protective deck, she would, in all probability, have proved a total loss. Had the accident occurred at sea, and at night, it is more than likely that three or four hundred souls would have gone down with the ship. That the Texas is still afloat is due to the fact that the water in which she sank was not deep enough to cover the top of the watertight bulkheads, and consequently it was possible to pump her out.

What with the mishap to the Columbia at the Southampton dry dock, when she came near having her back broken, the recent collapse of the Brooklyn dry dock, and now the sinking of the Texas, the recent record of the Navy Department has not been such as to bring to it much credit or strengthen the confidence of the public in its efficiency. The wretched mishap which is now the subject of inquiry might easily have involved the loss of a whole ship's company and done irreparable damage to the prestige of the navy, and it is earnestly to be hoped that the whole matter will be thoroughly ventilated and the blame placed where it rightly belongs.

THE CLOSE OF THE VENEZUELAN DIFFICULTY.

The cause of civilization has won a bloodless victory in the agreement which has recently been reached by the governments of the United States and Great Britain on the Venezuelan question. That the result was anticipated robs it of none of its value or significance.

It is but a few months since the two greatest nations upon earth, who claim to be the exponents of all that is best in modern civilization, were confronting each other almost with hand upon the sword-hilt. There was discernible an ill-suppressed exultation among those nations which are as yet under the thralldom of despotic power at the bare suggestion of a struggle to the death between the two great branches of the Anglo-Saxon race, which, under systems of government that differ chiefly in name, have proved that the freedom of the individual and the sovereignty of the people are the true secret of national wealth, power, and contentment. The mere thought of war made two things apparent, namely, that it would have been the most awful conflict in the history of mankind, both for its intrinsic horrors and for its irreparable loss; and that the cause of civilization would have been thrown back half a century.

But it was not to be. The spread of education, the broadening of international sympathies, enlightened views of the true relations of peoples and nationalities to one another, and above all the increasing control of passion by reason in the individual, are responsible for the present amicable settlement of the difficulty. "Peace hath her victories as well as war," and no triumph of arms, however brilliant, could have shed the glory upon either nation which is cast upon them collectively in the hour of their mutual forbearance.

The first definite announcement of the event came from Lord Salisbury at the banquet attending the installation of the Lord Mayor of London; an occasion on which the Prime Minister is always expected to make important announcements of a political nature. He said: "You are aware that in the discussion had with the United States on behalf of their friends in Venezuela, our question has not been whether there should be arbitration, but whether arbitration should have unrestricted application, and we have always claimed that those who, apart from historic right, had the right which attaches to established settlements should be excluded from arbitration. Our difficulty for months has been to define the settled districts, and the solution has, I think, come from the government of the United States, that we should treat our colonial empire as we treat individuals; that the same lapse of time which protects the latter in civic life from having their title questioned should similarly protect an English colony, but beyond that, when a lapse could not be claimed, there should be an examination of title and all the equity demanded in regard thereto should be granted.

"I do not believe I am using unduly sanguine words when I declare my belief that this has brought the controversy to an end."

It will thus be seen that the compromise secures a broad recognition of the vital principles contended for by each nation. The jealous care with which Great Britain guards the person and property of the meanest of her subjects is abundantly vindicated and is allowed to extend itself to every subject who can justly lay claim to it in the present case; while the rights of the United States under the Monroe doctrine as defined by the present administration in the case of Venezuela are acknowledged by Great Britain. The Venezuelan incident is practically closed, and closed in a common sense and harmonious way. The abiding effect will be beneficial to both parties, and will lead, it is hoped, to "arbitration" as the only civilized method of settling the household quarrels of the two great branches of the one great race.

Indiana as an Oil Field.

More than 2,700 oil wells were bored in Indiana in 1895, and hopeful, well informed men expect that enormous total will be surpassed in 1896. The oil industry of Indiana is coming to be one of the greatest in the State, and it is confidently predicted in some quarters that the State will soon rank with Pennsylvania and Ohio in the quantity of oil annually taken out of the ground. Last year was the first in the history of Indiana's oil industry that no serious accidents or explosions occurred.

The main oil field of Indiana borders on the northwest extension of the gas belt. It has the form of a huge L, extending east from Van Buren Township, Grant County, to Geneva, Adams County, and south from Geneva to Winchester, Randolph County. The first venture made for oil in the State was on the J. J. Clark farm, in Crawford County, in 1862–63. Oil and water were encountered in this well at the depth of 648 feet. In the Mifflin well, drilled in 1865, some oil was found at the depth of 135 feet.

A writer in the Indianapolis Journal holds that the Indiana field is only an infant. He looks for a remarkable development within the next few years. While 2,711 wells were completed, only 754 went dry in the year just passed.

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RAPID TRANSIT IN NEW YORK CITY.

The amended plans and a digest of the report for a scheme of rapid transit in New York City, which were submitted by Mr. W. B. Parsons, the chief engineer, at the last sitting of the board, will be found in the current issue of the SUPPLEMENT. They are worthy of the careful study of the citizens of the metropolis and incidentally of every one who is interested in the problems of city transportation.

It is safe to say that there is no municipal question—not even that of water supply—which is likely to become so perplexing in the twentieth century as that of how to handle the ever increasing multitude which day by day rolls like the flow and ebb of a tidal wave to and from the business centers of the great cities of the world. Questions of rapid transit are of the kind that cannot be taken in hand too early, for the perplexities which they have to solve grow by delay. The growth of urban population and the increase in the per capita travel is so rapid that provision for rapid transit should by rights be made well in advance of the demand for it; otherwise a city's traffic is certain to overtake and swamp its accommodation. This is the condition of rapid transit in New York to-day, where hundreds of thousands of its citizens are carried to and from the city amid miseries of overcrowding that are a positive disgrace to a metropolitan city.

The Board of Rapid Transit Railroad Commissioners was appointed about three years ago to deal with the whole question and provide a new railroad system. Its first plans called for a four-track underground road, beneath Broadway, from the Battery to the upper city, and above-ground tracks from the upper city to the suburbs. It was to cost something over $50,000,000. This scheme was vetoed by the Appellate Justices, who closed the Broadway route for underground roads, and declared the cost to be prohibitive. The plans embodied in the recent report of the engineer have been drawn to conform to the rulings of the court, which they do by avoiding Broadway altogether in the lower city and by bringing the cost below $30,000,000—on the face of it, a very reasonable figure for a work of this magnitude.

The present plan places the terminus at the Post Office, around which a loop would be constructed, so that there would be no switching or crossing of local and express trains. From this point there would be a four-track underground road beneath Center Street, Elm Street, and Fourth Avenue to Forty-second Street. Here the system would divide; one branch consisting for the present of two tracks, would extend beneath Park Avenue, alongside of the existing Harlem Railroad, to One Hundred and Tenth Street, where it would swing over to the left and proceed northerly as a three-track road to the Harlem River, the third track being used for express trains. Such a line would serve the extensive district lying beneath the Ninth Avenue Elevated and the present Harlem Railroad. The district north of the Harlem River and east of the Harlem Railroad, Mr. Parsons thinks, can be wisely left to be served for the present by the improved facilities which can be afforded by the Manhattan Elevated Railroad Company; and should this company refuse to extend and improve its facilities, it will be possible at any time to lay out and construct a new line.

The annexed district of New York lying to the west of the Harlem Railroad is to be served by acquiring private property, and building a railroad, elevated or depressed, as far as Tremont Avenue, where it would terminate for the present. Any further extension that might be required could be met by building an elevated road through Jerome Avenue.

Mr. Parsons is of the opinion that, before building this last extension, it would be well to open the underground road from the City Hall Park to the Battery. We fully agree with this suggestion, and indeed it is a question whether the Battery should not be made the starting point of the present amended scheme, and whether it would not be good policy to incur at once the outlay involved in the construction of this part of the line, even if the northern extensions of the road were curtailed thereby.

From Forty-second Street and Fourth Avenue a two-track road would be built through that street and up Broadway to Fifty-eighth Street, and a three-track road from there to Ninety-eighth Street. From Ninety-eighth Street to One Hundred and Thirty-fifth Street it would be continued as a two-track road, being carried across the viaduct at that point if so desired. Beyond this point the proposed cable or electric road of the Third Avenue line would give a through connection with Kingsbridge and Yonkers. It is further stated in the report that all the proposed roads on Manhattan Island are capable of being enlarged to four tracks.

The amended plans are a decided improvement over those rejected by the Appellate Court. The cost is only sixty per cent as great; and by taking the Elm Street route the difficulties of construction are greatly reduced and the objections from property holders avoided. Elm Street is to be widened, and the tunnel can be constructed simultaneously with this work, the cut being made in the open.

The opening of another great north and south thoroughfare contiguous to Broadway will greatly relieve the present congestion, and its underground road will undoubtedly give it in time an importance second only to Broadway itself.

By a study of the plans it will be seen that the rails will not lie more than about seventeen feet below street level; and if the station platforms are built level with the platforms of the car, it will not be necessary for passengers to descend more than thirteen feet to reach the train.

Horseless Carriages for Mail Service.

The Railway Mail Service, which has charge of the wagon deliveries in New York City, is about to experiment with horseless wagons with which to collect mail from the street boxes. The matter has been under the consideration of Second Assistant Postmaster-General Neilson for a long time, and discussing the question in his annual report, he says:

"It is hoped that the experiments with the horseless wagons, which will be tried during this fall, will be successful, and will enable the department to put these collection wagons in service at a greatly reduced expense, the theory being that the horseless wagon will be very much less expensive to operate than the horse wagon. This will be thoroughly tested, and the information that is needed gained in a very short time. The horseless wagon that is being constructed is built upon identically the same plan as the horse wagon, and will accomplish exactly the same result as far as the service goes, the only difference being in the mode of locomotion."

Data of this kind would be very valuable and render more real service to the industry than the offering of prizes for races in which the element of speed is too often considered in advance of the real practicability.

It is only a short time since the improved collection wagons were tried in New York City. The experiment has proved a complete success, for the new service accomplished all that was expected of it. Superintendent Bradley, of the Railway Mail Service, in an interview said:

"Our experience with the collecting wagons now in the service has demonstrated their usefulness beyond all doubt, and I consider them a pronounced success. They are not intended so much to save time in the transmission of mail from points of collection to receiving stations as they are to expedite the handling of the mails. This they certainly do. As it is now, mail collected from street boxes by one of these wagons is stamped, assorted, separated, and made ready for immediate shipment to points of destination as soon as it reaches the station. All the time it is in transit is thus used to good advantage. When we have a sufficient supply of these wagons, we can take mail collected from the street boxes to postal cars direct, without sending it to the general office or to stations at all. This will improve the service in all parts of the city and save much time."

The horseless wagon now building will be put in use in New York City in a week or so. A representative of Superintendent Morgan, of the City Delivery Service, said that it was the general impression that the horseless wagon service, if a success, would be used entirely in the upper and suburban parts of town, where the pavements were good, the streets less crowded, and the distances between the boxes and the branch post offices longer.

The Berliner Telephone Patents Case before the Supreme Court.

The case of the United States against the American Bell Telephone Company was argued in the United States Supreme Court on November 11. In some respects the case is regarded as among the most important before the court, as it involves the validity of the Berliner patents, owned by the Bell Company.

Attorney-General Harmon, Solicitor-General Conrad, and a number of attorneys representing special interests, appear in connection with the suit of the United States, while the Bell Company has a heavy array of counsel, including Messrs. James J. Storrow, James H. Choate, and Frederick P. Fish. The Standard Telephone Company is represented by General James McNaught and Myron Francis Hill, who have filed a brief on two points in behalf of the government. The Standard Company has no direct interest in the litigation, except as it affects the general use of telephones. It is said that a decision in favor of the government would tend to open the telephone to public use.

Owing to the importance of the interests involved, the court granted nine hours for argument, which will continue the case for about three days. Judge R. S. Taylor, of Indianapolis, opened the argument on November 11 in behalf of the United States.

HISTORY OF THE SUIT.

The suit began February 2, 1893, when the Attorney-General filed a bill in equity against the American Bell Telephone Company and Emile Berliner, asking for the annulment of its patent. An alternative prayer was made that if the patent was not declared wholly null and void, it should be repealed in part, as the court determined proper. The Berliner application for patent was filed June 14, 1877, but the patent was not issued until fourteen years thereafter.

The main points raised by the United States are:

First—That the patent is void for illegal delay in its issue.

Second—That it is also void on the ground that a prior patent was granted upon the same application to the same applicant for the same invention.

The patent covers what is known as the microphone. The Attorney-General will set up that the Bell Telephone Company "designedly and with intent to thereby prolong its monopoly, delayed and prolonged the pendency of the application for more than thirteen years after its control of the patent."

The Bell Telephone Company, in its answer, points out that the United States officials from the first have had entire control of the application for patent, and an express denial is made that there was any fraud, accident, or mistake. The company maintained that it had not designedly delayed the issue of the patent, with a view to extending its rights. It alleged that if there was any slowness, it was the act of the plaintiff itself, the United States.

The case was tried in the United States Circuit Court for the District of Massachusetts, where the contentions of the United States were sustained. The Bell Company appealed to the Circuit Court of Appeals, where the preceding decision was reversed on the ground that there was no evidence of dereliction of duty in the Patent Office, and the bill in equity of the United States was dismissed.

The case now comes before the Supreme Court on an appeal by the United States from the decision of the Court of Appeals. The same points first presented, as to delay, are still foremost, and the arguments of counsel on November 11 were directed mainly on these points.—Washington Post.

The Cire Perdu Process.

The revival of the "lost art," or ancient wax process, in sculpture has lately been accomplished in this country by a well known Rhode Island artist, Hippolyte L. Hubert, notably in a bust of the late Judge Carpenter of that State, says the New York Sun. The process is public, except in one particular, the hardening of the gelatine used. The clay or plaster bust is covered with a clay coating of even thickness; this is again coated with plaster, the clay being used to give the thickness of the gelatine; both clay and plaster are then removed in two sections. The clay is taken from the plaster and the space between the work and the plaster filled with gelatine, prepared by the secret process to resist the action of heat. The gelatine is cast into two moulds, closely adhering to every feature of the work, and is now prepared to receive the wax, which is attached to the gelatine mould until a thick enough coating is obtained, when the gelatine mould is at once removed, and may be melted and used again. The whole secret of the process is in the preparation of the gelatine so as to resist the action of the hot wax. The wax model thus obtained is hollow and very light, is an exact reproduction of the original bust, and may be given any finishing touches that the sculptor desires. Being susceptible to the action of the atmosphere and of heat, these wax models are kept floating in water until the time they are conveyed to the foundry. The work of the sculptor is then finished, and the success of the casting depends, of course, on the founder.

The Late Henry A. Mott.

Dr. Henry A. Mott, the well known chemist, engineer and author, died on November 8, in New York City. He was born at Clifton, Staten Island, in 1852 and was a grandson of Dr. Valentine Mott, the distinguished surgeon. He took the degrees of Engineer of Mines and Bachelor of Philosophy at the School of Mines, Columbia College, and in 1875 received the degree of Doctor of Philosophy. After a study of chemistry he acted as an expert and conducted some remarkable cases relative to the adulteration of baking powders with alum and also butter substitutes. In 1881 he became Professor of Chemistry in the New York Medical College and Hospital for Women. He was a member of many learned societies and wrote able scientific works, among which are "Was Man Created?" "The Air We Breathe," "Matter, Force and Energy," "The Chemist's Manual and Chart on Food." He was the author of many minor works and papers.

Our Anniversary Number.

Our supply of copies of this great semi-centennial number, although the edition was so large, has now become so limited that we again remind subscribers and others interested who desire a copy for perusal or preservation that they should be prompt in sending in their orders. It has been found necessary, as previously announced, to advance the price to twenty-five cents a copy, which should be sent with the order.

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IMPROVED WHITE LEAD GRINDING MACHINES.

The accompanying illustrations represent machines embodying the latest improvements for facilitating the grinding of white lead. They were recently built for the John T. Lewis White Lead Company, of Philadelphia, by the Robert Poole & Son Company, of Baltimore, and form quite a departure from the usual machines for such purposes.

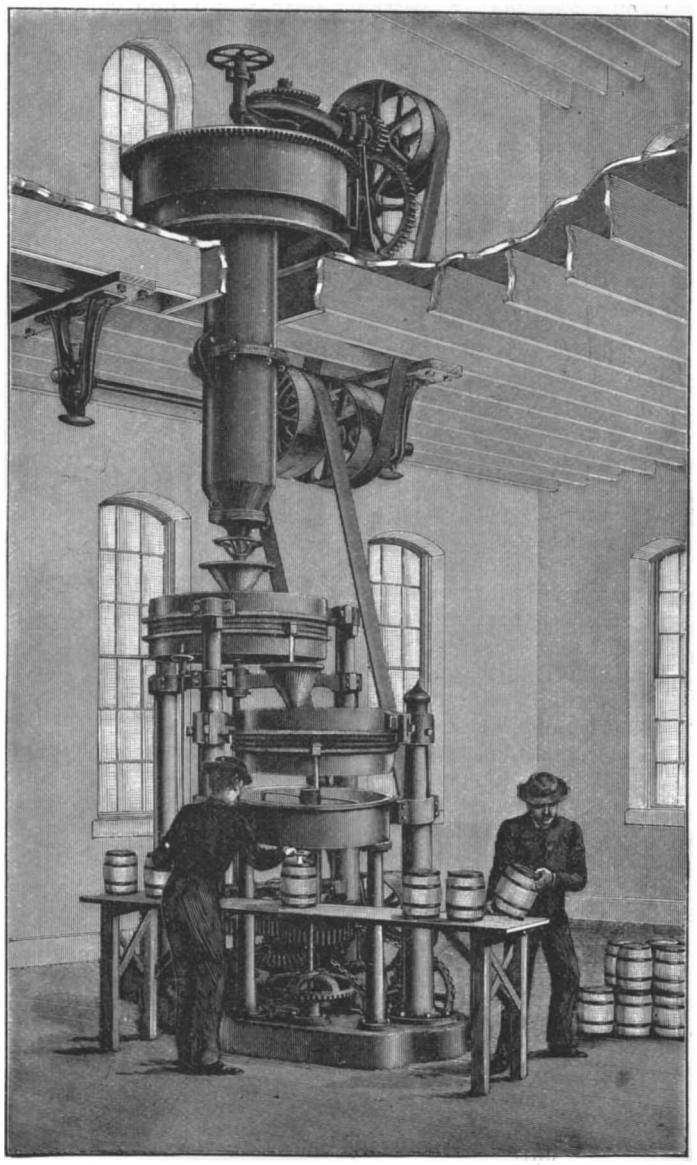
In the process of the manufacture of white lead, the lead, after coming from the corroding pots, where the pure or blue lead is treated with reducing acids, is ground in water to disintegrate all lumps of corroded lead before going to the settling tubs. The large machine illustrated herewith, which is known in the trade as a water mill, is designed to do this work. As the highest efficiency was one of the requisites, it was determined to depart from the usual light design and make a machine having heavy parts to be run at high speeds, and with all possible automatic details and labor-saving devices as well as the highest class of workmanship and best materials throughout.

The machine consists of a heavy bed plate of the box pattern, erected on solid concrete foundations, about 12 feet square. This plate carries four heavy square cast columns 5 feet long, on top of which rests a similar sized plate carrying the stones for grinding, which are 54 inches diameter of the best solid French buhr type. The under stone is the runner in every case. They are fitted in bronze baskets, and mounted on heavy spindles which drive by a universal joint device. There are four sets or pairs of these stones, making what is termed a double mill, although but one-half or two sets of stones only are in operation at a time; the other two sets are "spares." Under each set of upper stones there are placed two conveyors, driven by chain belt from the main shaft, to carry the material after the first grinding from the upper to the lower run of stones. Besides being positive this attachment economizes space, which would be necessary to obtain the same results by gravity. After passing its second grinding through the lower run of stones, the material is spouted away, and conveyed to the settling tubs.

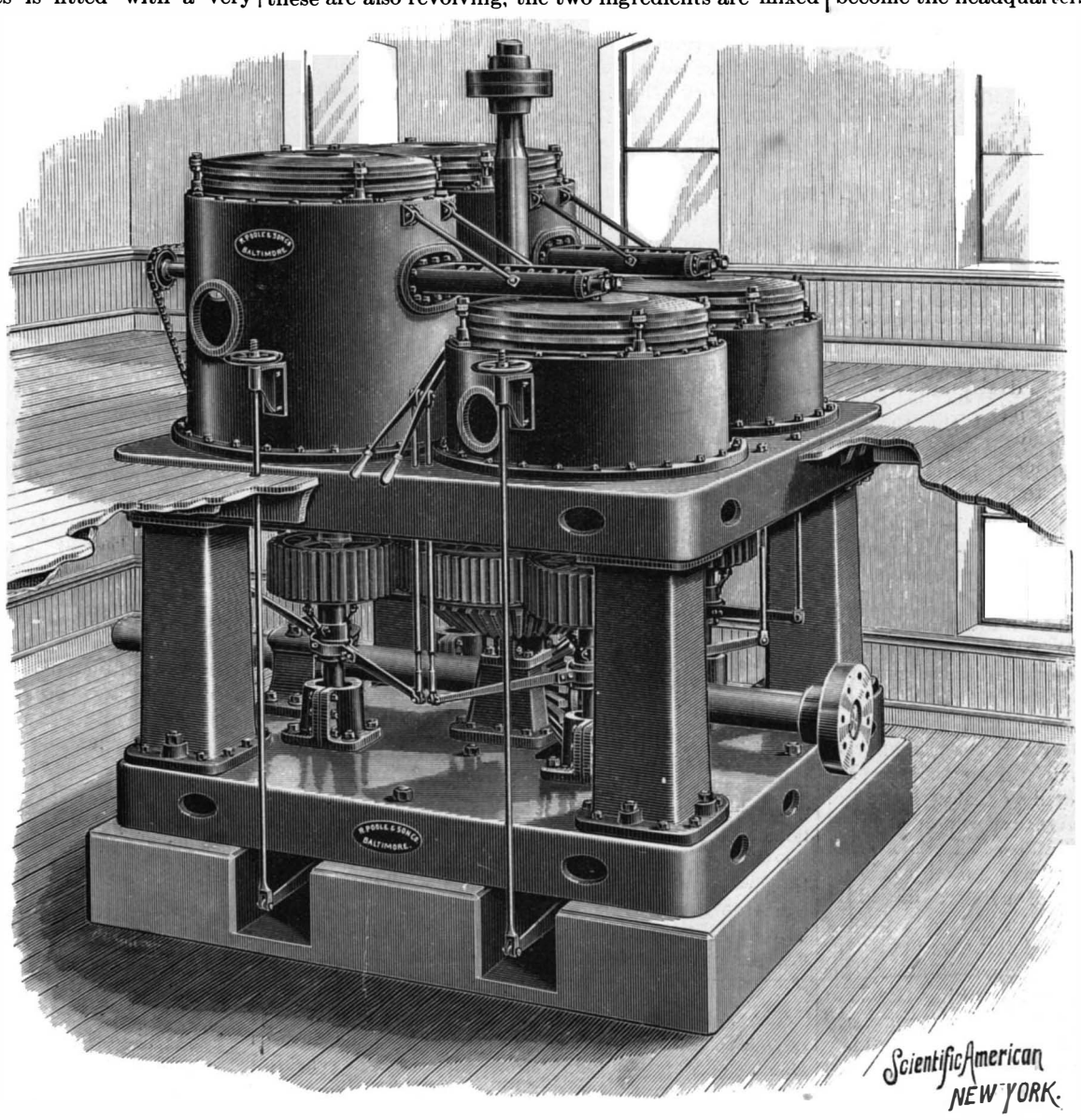
The main horizontal shaft of the machine connects directly with the engine, and the power is transmitted from this shaft to a central upright shaft by heavy machine cut bevel mortise gearing. From thence it is transmitted to the stone spindles by wood and iron spur gears, machine cut. Each stone pinion on the spindles is fitted with a very positive and powerful friction clutch, admitting of any pair of stones being thrown out at will. The toes of the spindles run in specially designed bronze steps, adjustable from above. All the driving mechanism is placed between the two bed plates in a compact yet well designed manner, and all parts are easily accessible, either for cleaning, adjusting or repairs. The operation is all controlled from the grinding floor, by suitable levers and connections. The floor space occupied is 12 feet by 12 feet, while the total height from lower floor to top of buhr casing is 14 feet 9½ inches. Total weight of machine on foundations, 112,000 pounds. The capacity of the machine is about 50 tons per day of 10 hours, requiring 75 horse power to drive.

After leaving the water mill, the product is allowed to settle by gravity in settling tubs, after which the water is evaporated by steam heat, and the lead is then ready to be mixed with oil. This is, in part, accomplished by a centrifugal mixer, shown at the top of one of the engravings. This machine consists of a cast iron base, with annular V slots, on which rests a cast iron pan 48 inches in diameter, 12 inches deep, with a circular hole in the bottom, which is opened and closed by a cast iron plug. Around the outer flange of the pan is fitted a segmental rack engaging with a bevel pinion in the head. The frame or head of the machine carries two shafts, one above the other, one for driving the pan and the other for driving the plows or stirrers which do the mixing and are fitted between the plug and the sides of the pan. The operation is very simple. The corroded lead and oil are put in the pan, and, as it revolves, they are carried under the stirrers, and, as these are also revolving, the two ingredients are mixed very thoroughly in a short time. The mixing may be continued as long as necessary, when the central plug can be raised and the mixed material allowed to fall into the receiver—a cylindrical cast iron receptacle placed immediately under the mixing pan. The capacity of the mixer is about one ton per hour, requiring 15 horse power in driving, and weighs nearly 5,000 pounds. From the receiver the material is fed mechanically into the oil mill to more thoroughly mix it, which is the last operation of the process. This mill is fitted with two run of best imported French buhr stones 36 inches in diameter under runner, one pair mounted to the side and above the other in cast iron cases resting on strong columnar frames, with lateral bracing, all fitted on substantial base plate. The stones are driven by suitable gearing from a horizontal shaft in the base, which in turn is driven from the main line shaft. The operation is similar in every way to the water mill, only these machines are not required to be as large and heavy. The material passes through the top stones and thence by gravity into the lower run of stones. From the lower stones it passes into the cooling pan to remove the heat engendered in the grinding, and is then packed in kegs for market as white lead. The machine requires about 20 horse power to drive and weighs about 10,000 pounds.

No attention seems to have been spared to make all of these machines of the very highest type of efficiency. With properly designed parts and best workmanship and materials, they form in their completeness one of the most thoroughly equipped plants in this line of manufacture to-day.



MIXER AND OIL MILL FOR WHITE LEAD GRINDING.



POWERFUL WATER MILL FOR GRINDING WHITE LEAD.

A Motor Car Club in London.

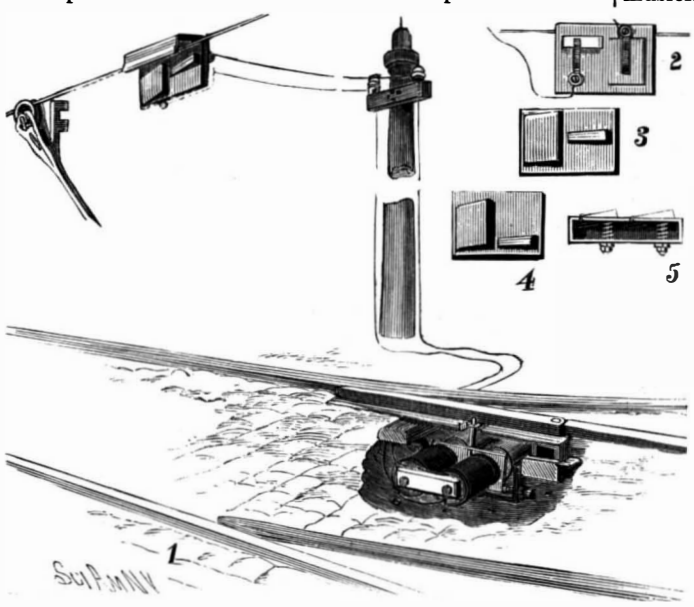
The London correspondent of the New York Tribune, in a recent letter, states that the first meeting of the Motor Car Club, which will soon occur, will excite less interest than a lord mayor's show, but it may lead to more important results. It will be a trial trip of horseless vehicles from the Hotel Métropole to Brighton, through Brixton and Reigate. Fifty-four vehicles have been entered for the contest. These will include two Daimler cars, which finished first and second in the race from Paris to Marseilles and back; several German vehicles, two Duryea cars from America, and a large number of English electric carriages and petroleum traps. It will be a remarkable show, and will attract throngs of spectators from the Embankment and Westminster Bridge all the way to the coast. Coventry has become the headquarters for the new industry of supplying what are, by an atrocious barbarism, called "autocars," which answer the requirements of the new act of Parliament, but there have been interesting experiments also in Colchester and other towns. One invention employs neither an electric battery nor a heating tube. It has no external flywheel and the oil lamp is not kept constantly burning. With electric omnibuses in common use the aspect of London streets will be changed, but the cabmen are not yet convinced that their occupation is threatened.

THE Scientific American Reference Book, published by Munn & Company, of New York, costs but twenty-five cents, but is worth, says the Spatula, of Boston, ten times that amount. It tells all about the patent and trade mark laws, and gives minute directions for securing the various kinds of protection for anything that's new and a fit subject for a patent, trade mark or copyright. The principal mechanical movements are illustrated by 150 diagrams, the steam engine is dissected and analyzed, the metric system is explained and hundreds of useful facts are gathered together and carefully indexed.

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AN ELECTRICALLY OPERATED RAILWAY SWITCH.

The illustration represents an electrically operated switch mechanism designed to automatically switch the cars from one track to another without action on the part of the motorman. The improvement has



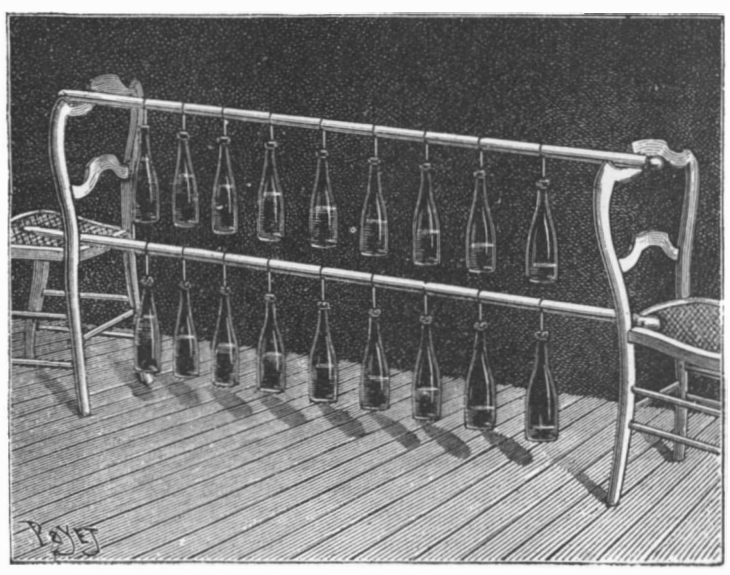
BROWNE'S ELECTRICALLY OPERATED RAILWAY SWITCH.

been patented by Walram S. Browne (Manufacturers' Paper Company), box 683, New York City. The main view illustrates the application of the improvement, and the small figures show further details of the contact devices. The improvement contemplates there being several switches on the line, and adjacent to each one are switch-operating magnets with pivotally mounted armature engaging a switch point in such way that when either of the magnets is excited the switch point will be correspondingly moved. The trolley wire is held in place in the usual way, and on it, near each switch, is a stationary contact device comprising a frame or casing with angular upper portion, and having at one edge a clamp which engages the wire, the contact plates preferably moving in recesses or openings in the casing when engaged by the contacts carried by the car. The car contacts are lugs bent outwardly from one side of a plate at the end of the trolley pole, and are in electrical communication with the trolley wheel, to utilize the trolley wire current to operate the switch mechanism. As shown in Fig. 2, the contact plates have springs to hold them normally in position to be engaged by the car contacts, and the springs are connected by circuit wires through the trolley wire supports with the switch-operating magnets. As shown in Figs. 3, 4, and 5, the casing of the stationary contacts is hollow, and the contacts are hinged at the edges of openings, with their outer faces inclined, and have stems on which are coiled contact springs. As the car approaches one of the switches, one of the car contacts engages the stationary contacts on the trolley wires to actuate the switch point and set the switch as desired, the car contacts being arranged to actuate only the particular switch or switches designed to be moved.

THE MUSICAL BOTTLES.

The accompanying figure represents a simple and easily constructed musical instrument. It consists of a number of ordinary glass bottles filled with a certain quantity of water, the height of which is varied according to the pitch of the note to be obtained. After a few tentatives, it will be possible to reproduce all the notes and their octaves, including the sharps and flats. The tuning of the apparatus, however, requires a good musical ear.

The bottles are suspended by the neck, by means of strings, from two broom handles resting upon the backs of two chairs. In order to produce the sound, the bottles are struck with two rulers, or, better, two drum sticks. With this arrangement, airs in two parts may be played; and there may be two performers, one playing on one side without interfering with the performer on the other side. In the hands of good musicians this apparatus is very pleasant to listen to. —G. Tissandier.



THE MUSICAL BOTTLES.

Large Gifts to Libraries.

In a recent number the Critic gives detailed lists of the large gifts of money that have been made for libraries in this country. The splendid record it has to present it hopes may inspire other rich men to go and do likewise. Here are the facts collected:

New York Public Library.—Astor Foundation—John Jacob Astor, $400,000; William B. Astor, upward of $550,000; John Jacob Astor, $700,000. The value of the total endowment of the Astor Library on December 31, 1894, was $2,105,871.87. Lenox Foundation—Mr. James Lenox's gifts to the Lenox Library from 1870 to 1880 (the year of his death) were, in 1870, $300,000; 1871, $100,000; 1872, $100,000; 1874, $130,000; 1875, $85,000; 1876, $20,000; total, $735,000, besides books, works of art, etc., and ten lots for the library's site. The value of all these gifts has considerably increased—especially that of the real estate. Tilden Foundation—The amount already handed over by the Tilden estate to the New York Public Library is something over $2,000,000. The total amount the library is expected to realize from this source is set at $2,125,000.

By the will of the late John Crerar, the John Crerar Library, of Chicago, was made his residuary legatee, but with a provision that the executors of the estate should use their discretion as to the time of the payment of this bequest. Under this will the directors of the John Crerar Library have received from the trustees and executors of the estate the sum of $1,851,131, and they have been informed that the trustees still hold for the library property of an estimated value of $863,060. This would make the total amount of Mr. Crerar's bequest $2,714,191.

The bequest of Mr. Walter L. Newberry to the Newberry Library, of Chicago, was one-half of his estate, which, at the time the bequest became available and was set apart for the library, was valued in round numbers at $5,000,000, thereby making the endowment to the library $2,500,000.

The gifts made by Mr. Carnegie to the library in Pittsburg, Pa., bearing his name are $800,000 for the erection of the main building, $300,000 for the erection of branch buildings, and an endowment of $1,000,000 for the maintenance of the art gallery and museum—a total of $2,100,000. Altogether Mr. Carnegie has within the last few years given more than $4,000,000 to the cause of public education in its wider sense—for the libraries erected by him almost invariably are devoted to music, art, and science as well. The principal of these are at Allegheny ($300,000), Homestead ($400,000), Braddock, and Johnstown, Pa.; Fairfield, Iowa; and Edinburgh, Ayr, and Dunfermline, Scotland.

Mr. Enoch Pratt offered the city of Baltimore, on January 21, 1882, a library building, costing about $250,000 and an endowment of $833,333.33, on condition that the city create a perpetual annuity of $50,000, payable to a board of trustees, named in the first instance by Mr. Pratt and having the right to fill vacancies in their own number. This offer was accepted and the library founded.

The property bequeathed by Dr. Rush for the establishment and support of the Library Company of Philadelphia amounted to about $1,060,000.

The endowment which Mr. Mortimer Fabricius Reynolds made for the Reynolds Library, of Rochester, consisted of real estate, which is valued at present as being worth certainly over $500,000, and probably $600,000.

Mr. Leonard Case gave during his life to the Case Library, of Cleveland, $20,000 in government bonds, besides smaller sums from time to time, amounting in all to, say, $25,000. In 1876 he gave real estate, then valued nominally at $300,000, but now worth $500,000. The total value of the endowment of the Case Library is now estimated at $600,000.

The Minneapolis Public Library was built, and is at present sustained, for the most part, from the product of taxes. Of the original cost of the building ($360,000), however, about $61,000 came from private subscriptions, usually of $5,000 each. Moreover, there is combined with the library, for the term of ninety-nine years, a proprietary institution, the Minneapolis Atheneum, which has funds amounting to $200,000. This property was the gift of a certain Dr. Kirby Spencer, a citizen who died about 1860, bequeathing his estate in this way. At the time of his death, the property, which was in real estate, was far less valuable than now. It yields a varying income, sometimes above, sometimes a little below, $8,000 a year. This sum is used to supplement the funds derived from taxes, amounting during the present year to about $54,000.

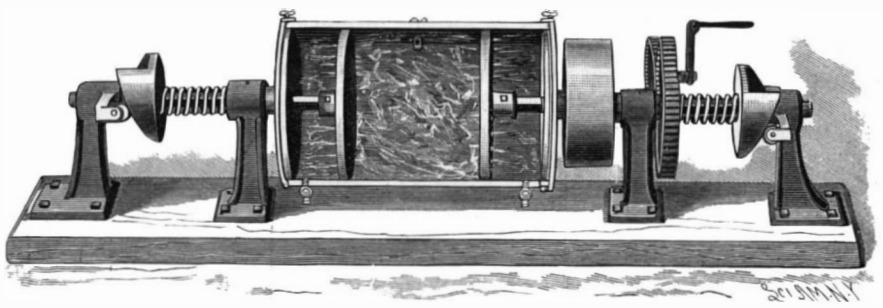
The executors received in 1881, under the will of Judge Forbes, of Northampton, Mass., $252,260. The money was suffered to accumulate for ten years, in accordance with a provision of the will and a vote of the town. In 1894 the executors delivered to the trustees appointed by the city a building and lot which had cost $128,994, $1,350 of other non-productive property, and funds amounting to $355,565. This is the real endowment of the library, and not the amount originally received.

Mr. George Peabody endowed the Peabody Institute, of Baltimore, with $1,240,000, but as the Peabody Institute, besides a library, includes a conservatory of music, an art gallery, and a course of lectures, and all of these are in part or wholly supported from the income of this endowment, it is almost impossible to state just what the endowment really is.

To the above list must be added the recent bequest to Princeton University of a library which is to cost over $600,000. The design of the building will be carried out upon the lines so common in the English universities. It is to be made the most complete and perfect university library of its kind in this country.

AN IMPROVED WASHING MACHINE.

A machine designed to rapidly force the washing liquid many times through the clothes with the least possible expenditure of labor or power, and without danger of injury to the clothes, is shown in the accompanying illustration, and has been patented by William Acheson, of No. 2307 Penn Avenue, Pittsburg, Pa. The cylindrical clothes receptacle has in its periphery a removable cover, through which are introduced the washing liquid and the clothes to be washed, and its heads have hubs which turn in bearings on suitable standards. The water is forced through the clothes by reciprocating



ACHESON'S WASHING MACHINE.

perforated plungers or dashers whose squared shafts slide in and turn with the hubs, there being on one of the hubs a pulley to be connected by belt with a source of power, or the machine may be operated by hand through a gear wheel on the hub, which meshes with another gear wheel actuated by a crank. The reciprocating motion is given to the plungers by double cams on the outer ends of the plunger shafts, the cams engaging friction rollers to give inward impulses, while the return motion is effected by springs coiled on the shafts. The cams being double, two full strokes are given to the plungers during each revolution of the receptacle, and therefore, with the machine running at a speed of twenty-five revolutions a minute for fifteen minutes, the washing liquid will be forced through the clothes and back again 750 times. The receptacle has outlet faucets for discharging the wash water when desired.

How Piling is Driven in Bavaria.

Henry A. Carpenter, United States commercial agent at Furth, Bavaria, writing of the opening in that country for American manufacturers, says:

"The manner of driving piling here would indeed make an American contractor smile. The method is as follows: A simple block and fall arrangement is rigged over the pile and to the end of the rope running on the pulley, and fastened to the weight are about twenty-five smaller ropes with hand pieces. Twenty-five men grab these and at a signal from one of their number, all pull together. The weight goes up about eighteen inches or two feet, when the men relax their hold and the weight drops. It is unnecessary to state how long it takes by such a method to drive a pile, or how much more effectively a small dummy engine would do the work. In the erection of buildings the same tedious process is employed; for every stone to be raised requires the strength of a pair of horses and about fifteen men tugging away at the ropes. The machinery manufactured and used in America for such purposes would do away with this clumsy method."

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The Spitting Habit and Spread of Consumption.

In England and Wales, according to Dr. W. Murrell, from 50,000 to 60,000 people die annually from consumption; and another 50,000 from other tuberculous diseases. From 1848 to 1880, 1,702,002 deaths were registered due to phthisis, the majority being young adults. No other disease claims an equal number of victims. Its infectious nature being well recognized, every effort should be put forth to minimize its communicability. Among the many means by which this dread disease may be disseminated, one of the most prevalent arises from the consumptive's expectorations. This sputa, as bacteriologists have shown us, carries the tubercle bacillus in varying quantities. When dried, these germs are taken up by the atmosphere, then inhaled by the well and sick.

By this means there is no reason to doubt that phthisis is often conveyed directly to individuals. It has been proved beyond a reasonable doubt that these diseased germs are also given off by the consumptive's breath and that husbands have taken it from wives and wives from husbands. We have here a source of infection to which enough attention has not been given. Of all the filthy habits to which a considerable portion of our people are given, perhaps the very worst is the spitting habit.

No place is too sacred for them to pollute. On the street, on cars, boats, in stores, in our homes, we are constantly reminded of the passage of the spitter. Ladies trail their gowns through this filth, bring it into their homes, when, having dried, the bacteria are given off with every movement of their garments. That the consumptive may cause a health resort to become a place to be shunned is exemplified in the case of the Riviera. Its climate is most salubrious, and when consumptives first went there this disease was an unknown quantity; now it has become as firmly established there as in any consumptive country. The air and soil have become so contaminated that the natives have fallen victims to this disease. The washerwomen in particular have been attacked. The Riviera is no longer a health resort, but a place to be avoided by weak lunged persons. California's beautiful climate has brought thousands of consumptives there for their health. In the southern portion of the State in particular there are evidences already that this disease is spreading to those who have heretofore felt that there was no danger in living among consumptives. In a word, may not foci for the spread of phthisis be already established in various towns, due to the contamination of soil and air? If so, how long will it be before these towns will cease to send out alluring advertisements welcoming the consumptive to come and make these places their homes? Not very long we believe after the masses have learned the truth concerning a disease which carries off more persons annually than any other single disease. The danger of dissemination can be greatly minimized by regulating the care of consumptives. Indiscriminate expectoration must not be tolerated. Hotels should have some disinfective fluid to be daily put into the cuspidors about the offices and halls. The same method should be carried out in all public buildings. The handkerchief should be used, as a rule, by every person when it becomes necessary to expectorate. Consumptives should have pieces of cloth or paper which can afterward be burned. What a travesty this is on our boasted civilization to see signs with these words, "No spitting on the floor," meeting us at every turn.—Pacific Medical Journal.

Animal Antipathies.

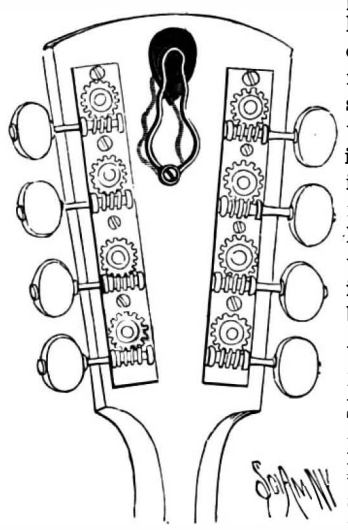
A correspondent of the London Spectator describes a curious scene witnessed at the Zoological Gardens. He had for companion a gentleman, now dead, who was a dwarf, and walked with crutches. "As soon as the tiger saw him he lashed his tail, and finally stood up on his hind legs against the bars and remained in a state of great excitement. We who saw it at the time were much struck by the sight, though whether its behavior was due to alarm or intense curiosity we could not tell." Probably the tiger's excitement was due to neither, but to the latent antipathy which many animals feel for anything abnormal, either in their own species or even among others with which they are well acquainted. It is the feeling which prompts storks or rooks to destroy at once the young of other birds which are hatched from eggs placed in their nests, and dogs to bark at cripples or ragged beggars, or, as in this case, roused the dislike of an observant Zoo tiger who saw men of normal size and proportions pass every day before its cage.

The belief in permanent antipathies among animals is very ancient. It appears in all the monkish tertiaries. There the otter is always the enemy of the crocodile, and the unicorn of the elephant; while the dragon is hated by the hart, and in turn dislikes all beasts, including the panther, whose exquisite perfume, so agreeable to all other animals, disgusts the dragon, who runs away the moment he smells it. Turning from legend to facts, we find that animal antipathies have a range as wide or wider than the instinctive dislikes of men. They are in part exactly the same in kind as the latter, one animal exciting in another exactly the same disgust that a baboon or a black beetle does in the minds of many human beings; but the list of hereditary enemies—of one species which is the sworn foe of another, and has left in the weaker species an inbred and ancient sense of horror and fear—is far longer than the list of hereditary enemies of the dominant species—man.

Instances of purely instinctive, inexplicable antipathy are naturally the least common, but they are very marked and definite examples. It is quite impossible, for instance, to account for the intense disgust which the camel excites in horses. They have been associated in many countries for centuries in the common service of man, and early training makes the horse acquiesce in the proximity of the creature which disgusts him. Otherwise it is far more difficult to accustom horses to work with camels than with elephants, precisely because the repugnance is a natural antipathy, and not a reasoned fear. They get used to the sight of an elephant, but the smell of a camel disgusts and frightens them. English horses which have never seen a camel refuse to approach ground where they have stood. Recently a traveling menagerie was refused leave to encamp on a village green in Suffolk, not because it was not welcome, for a wild beast show is always vastly popular, but because the green was also the site of a market, and the farmers' gig horses invariably refused to be driven across it after camels had stood there. Yet recently two bears were being exhibited in Harley Street, and no horse showed any fear of them. One horse almost touched the larger bear, but neither it nor the team of a four-in-hand which passed showed any nervousness.

A MUSICAL INSTRUMENT ATTACHMENT.

The illustration represents an attachment for mandolins, guitars, etc., played by the use of a pick or plectrum in the hands of the performer, whereby the pick may be conveniently supported and always at hand with the instrument while not in use, while readily removable from its holder for playing when required. The improvement has been patented by Adam G. Mahler, of No. 107 East One Hundred and Twenty-fifth Street, New York City. The holder is formed of a single piece of spring wire, bent as shown in the engraving, and having its ends formed into segmental eye parts adapted to be engaged by a small screw and washer, by means of which the holder is attached to the neck of the instrument. The holder may, if desired, be secured to some other part of the instrument, and is equally well adapted for holding other forms of picks.



MAHLER'S PICK HOLDER.

Well Water.

The drainage into wells is often very bad, with the result of typhoid fever and many other germ diseases. On account of this danger, Dr. Koch suggests that an iron tube two or three inches in diameter—with its lower end perforated—be placed in the center of the well, and the surrounding space filled with fine gravel up to the highest point of water level. This is then covered with sand to the top of the well; and a pump attached to the end of the tube makes a very effective tube well. All water in passing through the layers of sand and gravel is effectively filtered, and the nitrifying organisms change the filth into harmless nitrates. A filter bed like this removes, too, from 80 to 90 per cent of the bacteria, and greatly, very greatly, lessens the danger to which all are subjected who drink shallow well water.—Popular Science News.

Counting and Tying Postal Cards.

Two of the most interesting automata now working within the limits of the United States are those used by the government for counting and tying postal cards into small bundles. These machines were made in Connecticut, and the two are capable of counting 500,000 cards in ten hours and wrapping and tying the same in packages of twenty-five each. In this operation the paper is pulled off a drum by two long "fingers" which come up from below, and another finger dips in a vat of mucilage and applies itself to the wrapping paper in exactly the right spot. Other parts of the machine twine the paper around the pack of cards and then a "thumb" presses over the spot where the mucilage is, and the package is thrown upon a carry belt ready for delivery.—The Argosy.

Science Notes.

At the recent B. A. meeting Prof. S. P. Thompson suggested, says the Electrical World, that X rays may be the ordinary means of optical communication among fire flies, and that, for that reason, Providence had not found it necessary to furnish the insect's eyes with a lens.

Sir John Eric Erichsen, who died recently, was born at Copenhagen in 1818, but was brought up in England. He became professor of surgery and surgeon to University College Hospital in 1850, and was elected president of the College of Surgeons in 1880. It is not too much to say that the name of Erichsen is known to every surgeon throughout the civilized world.

Prof. Lewis Swift, of the Mount Lowe Observatory, California, discovered a bright comet just about sunset on Sunday, September 20. The comet was only one degree from the sun. The next evening he observed the comet again, and found that, in consequence of its recession from the sun, it had diminished in brightness.

Nature records the death of Mr. W. C. Winlock, known for his contributions to astronomy. Mr. Winlock was assistant in charge of the office of the Smithsonian Institution. The death is also announced of Dr. J. P. E. Liesegang, a voluminous writer on photographic matters, and the founder of the Photographische Archiv; and of Dr. J. A. Moloney, who took a prominent part in the Stairs expedition to Katanga.

Experiments show that a light of one candle power is plainly visible at one mile, and one of three candle power at two miles. A ten candle power light was seen with a binocular at four miles, one of 29 at five miles, though faintly, and one of 33 candles at the same distance without difficulty. On an exceptionally clear night a white light of 3·2 candle power can be distinguished at three miles, one of 5·6 at four, and one of 1·2 at five miles.

M. Peres has investigated the cause of the severe gastric troubles which occasionally follow the eating of pâte de foie gras, and finds that they arise from the presence of an excess of oxalate of potassium in the goose liver. It appears that the producers of these diseased livers are wont to shorten their period of development and to produce larger livers by administering to the bird salt of sorrel, otherwise called binoxalate of potash. This process has, heretofore, been kept carefully secret, says the American Druggist.

M. Moissan has found that when acetylene is allowed to impinge upon pyrophoric iron, which has been reduced by hydrogen at the lowest possible temperature, the gas is decomposed with incandescence into its constituents. At the same time condensation takes place, and a liquid hydrocarbon, rich in benzine, is produced. The same result is obtained if pyrophoric nickel or cobalt is substituted for the iron. No gaseous compound of either metal is obtained, and he concludes that the decomposition is due to physical causes.

There is a means of physical investigation known whereby we may ascertain how many atoms there are in the molecule of a solid substance dissolved in a liquid, says the Progressive Age. This is to find out how much a given quantity of the substance dissolved raises the boiling point of the solvent liquid. This alteration in the boiling point depends on the number of molecules dissolved; and the number of molecules depends, of course, on the number of atoms in the molecule. Orndorff and Terrasse, applying this method, have found that sulphur dissolved in boiling bisulphide of carbon, or benzol, or toluol, has nine atoms in its molecule; while in boiling carbolic acid or naphthalene it has eight. In boiling monochloride of sulphur it has only two.

In a letter to the editor of Nature, Prof. A. E. Munby says the cheap production of acetylene has come as a great boon, and is now in regular use for laboratory blowpipe work. The apparatus in use consists of an aspirator holding about fifteen liters, permanently connected with a water supply, and possessing a quarter inch aperture exit tap—the water flows in from below to minimize absorption; at the top a three hole rubber cork carries an upright pipe, passing through the table, which serves for filling the aspirator with gas or using the gas on the table, a second pipe goes to the blowpipe, and a third carries an open mercury manometer. For filling the jar the calcium carbide is placed in a four ounce bottle, closed by a cork carrying a small separating funnel from which the water drops; the gas passes to the aspirator through a wide glass tube, which acts as a reversed condenser, returning most of the water vapor to the bottle. With the large exit to the aspirator the gas can always be collected under a reduced pressure of several centimeters of mercury, which quite provides against any sudden rushes of gas; the operation takes some ten minutes, and requires practically no attention. In using the gas the water is turned on with all taps closed for a few seconds, to correct any reduced pressure caused by absorption, as shown by the gage—this is very slight indeed—and then the gas tap fully opened and the flame regulated entirely by the water entrance. To bring the gas into use takes hardly any longer than with an ordinary gas blowpipe.

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Some Feral Types of Patagonia.

BY GEORGE E. WALSH.

The types of dogs represented in the Arctic belt assimilate the colors, habits, and general characteristics of the wolf, fox, dhole, and other wild animals, so that it is sometimes difficult to distinguish the breeds from which they must have originally sprung; and the truth was never more forcibly illustrated that all of our dogs have a tendency to found new races of their own, and to return to the old primal stock, when freed from man's control and left to their mutual selection. The white "huskies" of the British Northwest, the "reindeer dogs" of Greenland and Lapland, and the Athabaskan dogs of Mackenzie River district, are types resembling each other in many respects, but it is easier to trace their relationship to the lynx, fox, timber wolf, coyote, dhole, and similar wild animals, than it is to discover points of resemblance to the various domesticated breeds. White is the dominant color of the circumpolar world, and the dogs have been influenced in the color of their shaggy hair by the climate just as much as the bear, fox, ermine, reindeer, owl and ptarmigan; and their color resemblance to the wild animals must not be attributed entirely to their wild habits and associations with degenerate companions.

In the southern hemisphere, the semi-wild feral types partake of the same characteristics. The dogs of the Patagonian Indians, the semi-wild canines of the sheep raiser, and the hunting dogs of the few white settlers in that solitary region, are all of different origin, but through association and cross breeding they have come to resemble each other in many respects and to assume the colors and characteristics of the various wild animals. The chief fauna of Patagonia with which the dogs would associate are the wolf, fox, puma, and coyote, and it is not difficult to see the influence of these animals upon their habits and looks. The sheep raisers of Patagonia have introduced the Scotch collie, but in their new home they have undergone changes that make them very different from the domesticated breed we are accustomed to. The white settlers who make a living in hunting brought the greyhound to their adopted land, and from this breed nearly all of the hunting dogs originally sprung. The Indians own flocks of dogs that are either mongrel greyhounds or a cross between the greyhound, Scotch collie, and the wild animals. They have degenerated to such an extent that the fine characteristics of the domesticated breed are nearly extinguished.

The dogs of Patagonia are so numerous that they wander over the country in a semi-wild condition in great packs, but, like their cousins in the Arctic belt, they form a very important factor in the lives of the people. Without the dogs, half the industries of the country would prove profitless. As the inhabitants of the circumpolar regions depend upon their dogs to drag them across the snow and ice, to hunt for them in cold weather, and to perform various other services that no other animal could do so well, so the white settlers and the Indians of Patagonia place their main reliance upon their dogs in hunting the guanaco, the ostrich, and the skin animals and in watching their enormous flocks of sheep.

Patagonia is a limitless field for the sheep raiser, and over the vast stretches of country flocks of sheep numbering many thousands roam at will, feeding upon the rich vegetation which nature provides with a lavish hand. The ranges are so wide that there is little danger of one man's flock encroaching upon the territory of his neighbor. But there is danger from wild animals and wilder dogs. The country is full of wild packs of dogs that have strayed from their masters and adopted the wild life of the wolf and fox. They are wilder and fiercer than most of the animals that we ordinarily place in the category of "wild beasts." The only wolf found in Patagonia is the aguará, a small, shy, and almost harmless creature, but the wild dogs are really a species of wolf, fully as savage and bloodthirsty as the great northern timber wolf. They hunt in packs, and, when they have been separated from any human companionship for several generations, they are as bold as the fiercest wolf of the circumpolar region.

The sheep raisers have consequently had to raise a shepherd dog capable of competing with these wild dogs, and the Scotch collie has been bred for this purpose in a cross with the greyhound. The sheep dogs of Patagonia are perfectly adapted to the country. They retain all the valuable characteristics of their Scotch ancestors, with the added strength and fierceness of the Patagonian greyhound. Five or six of these shepherd dogs will watch a flock of a thousand sheep, and do it so well that the shepherd has perfect confidence in the safety of his property. Many of the flocks number two and three thousand sheep, and one man will have this number under his care. With a pack of a dozen good dogs he can manage them with as much ease as another man could his thousand. His dogs understand their duties thoroughly, and the shepherd has trained them to work singly and together so well that there is never any confusion. In such a pack there is one dog that all the others recognize as their superior, and he is the leader of the pack, and so intelligent is this creature that it seems as if he interpreted to the others the wishes of his master.

If a pack of wild dogs should suddenly start a commotion among the sheep on one side, the shepherd dogs are called together in a hurry. If the shepherd happens to be away, the alarm is given by the collie nearest to the scene. Instantly the leader of the pack takes up the notes of alarm and calls his forces around him. Thus bunched together they pounce down upon the wild dogs or animals like a small hurricane. There are no wild dogs that can withstand the fury of these mongrel collies, for they have the blood of excellent ancestors in their veins, which impels them onward in the fight to their very death. But it is rarely that one is killed, for they work together so well that the wild animals have no chance to resist them successfully. They are like the well trained and disciplined soldiers of a civilized nation fighting the wild savages of an unsettled country, and the results are about the same.

But protecting the sheep from the wild animals is not by any means the only or most important work required of the dogs. It is their duty to look after the sheep during the quiet hours of the day when no danger threatens. While the shepherd is attending to other duties, or quietly resting by his camp fire, the dogs must keep a good lookout for the sheep, and should any of the frolicsome ones become too far separated from the flock, the dumb shepherds must corral them in. Occasionally two large herds owned by different shepherds get together and become apparently hopelessly mixed. At such a time no human being could go among the sheep and separate them into their respective flocks. The shepherds, dangerous rivals probably in the business, and possessing antipathies for each other that sometimes lead them into deadly fights, confess their helplessness to each other, and trust everything to their intelligent collies. As if by instinct, the dogs know each member of their respective flocks, and they begin the work of separating them in a way that calls for admiration. Out and in the mixed multitudes of bellowing sheep they run, singling individual sheep, and driving them into their proper ranks. The rival dogs never quarrel, but work rapidly until the flocks have been satisfactorily divided.

How they do this no one seems to understand. It appears almost incredible that they should know each sheep in a flock of one or two thousand, or that they can distinguish one from the other, and yet such is their intelligence one is forced to the conclusion that they are able to make some such distinction. Certain it is that they divide the flocks both to the satisfaction of their masters and their own canine leaders. Count the flocks beforehand and then again after the collies have finished their work, and the figures will be found to tally every time. To prove, furthermore, that the dogs get the right sheep in the separate flocks, experiments have been made by which the members of each herd were distinguished by small marks of paint daubed on the backs of the animals. This marking was done without the knowledge of the dogs, and the sheep were immediately mixed together so that the canines could not have time to familiarize themselves with the marks.

The hunting dogs of Patagonia are developed almost as marvelously as the shepherd dogs, and the work they are called upon to do is quite as difficult. In hunting the ostrich, the Indians employ their dogs. They are fleet of foot, but not quite equal to the wild ostrich. When the ostrich is scared up, the pack of hunting dogs make a wild race across the plains after the gigantic bird. There is no fleeter runner than the ostrich, and the hunters are mounted on the best horses they can secure. The great ungainly looking creature stretches out its wings, lowers its head and neck, and scurries across the country like a scare crow, and, if it kept straight on in its course, it would leave dogs and horses in the rear. But the noise of the pursuing hounds startles and frightens it and it resorts to a trick that always gives it the advantage of the dogs, if not of the hunters. When the pack of hounds are the least expecting a change in the course of the race, the ostrich suddenly springs many feet to one side, and starts off at a very different angle. The hounds are unable to check their headlong career for some time, and when they have finally stopped enough to wheel about the game has placed a hundred yards between them. Most of the hunting dogs are so demoralized by this proceeding that they slink away and refuse to renew the chase.

The hunters, however, have been waiting for this dodge, and just as soon as the big bird has swerved off to the right or left they raise their arms over their heads and swing their peculiar lasso through the air. This lasso is nothing more than a rope with a fork at the end on which two little stones are fastened. These stones are thrown with such dexterity through the air that they wind around the legs of the ostrich and entangle him so that he is thrown to the ground. The bird is never so puzzled as when brought to the earth in this way. It has not calculated upon the hunter's stratagem, and it is completely nonplussed by the sudden appearance of the strings around its legs. Some old hunting dogs become so used to this sport that they are not at all demoralized when the ostrich dodges them, for they know that their masters will accomplish in doing what they failed in. Like the pointer or setter, they realize that their work is limited to starting up the game and chasing it to the point where the hunter can capture it.

The hunting dogs are trained also to round up the guanacos. They work in large packs, and completely surround the prey before the alarm can be given, and then they close in upon them and kill them with their sharp teeth and powerful jaws. In this work they are invaluable, and they are worth a dozen cow boys. In hunting birds and wild animals the Patagonian dogs are famous for their persistence and intelligence, but when freed from their master's control they degenerate and become worse than the wildest animals of plain or woods.

The dogs have thus become in many parts of South America a veritable pest. Introduced to help the hunters and sheep raisers, they have become a menace to the chief industries of the country. They wander over the plains in packs large enough to make it dangerous to unarmed travelers. There is a great attraction for the dogs to desert their masters and seek a living by themselves on the plains. There are plenty of sheep and lambs and other animals that make juicy eating for them to capture, and their owners have to employ the strictest discipline to keep their canine friends from deserting them. Good dogs must be chained up except when on the hunt with their owners. To neglect this for a few weeks would ruin the finest hunting dog in the country.

The dogs became such a pest ten years ago that the large sheep ranchmen had to offer bounties for their scalps to protect their own interests. The wild dogs killed the sheep by the hundreds and thousands, and the nuisance increased rather than diminished. By offering bounties for their scalps the numbers were reduced somewhat, and the shepherds could feel comparatively safe once more.

There is likely to be another uprising of the wild canines in Patagonia which will greatly injure the wool industry of the country if something is not done to exterminate the roving packs of wild creatures. They are so productive in their wild condition that they multiply rapidly, and in ten years they easily quadruple their numbers. Roaming at will in a country that offers all the food they need, and with few dangers or extremes of climate, they naturally thrive, and the death rate among them is so limited that travelers rarely find the carcass of a dead dog on the plains, although the whitened and bleaching bones of innocent sheep are as plentiful as trees.

The Emission of Perfume by Plants.

A series of investigations made by M. Eugene Mesnard, in the laboratory of experimental biology of the High School of Science at Rouen, indicates that light, and not oxygen, is the chief cause of the transformation and destruction of perfumes, but that these two agents seem in many circumstances to unite their efforts. The action of light makes itself felt in two different manners: on one hand, it acts as a chemical force capable of furnishing energy to all the transformations through which odorous products pass, from their elaboration to their total resinification; on the other hand, it exerts a mechanical action that plays an important part in the general biology of the plants, and this property explains, in fact, the manner of emission of perfume by flowers. The author thinks that the intensity of the perfume of a flower depends on the equilibrium that is established at every hour in the day between the pressure of the water in the cells, which tends to expel outward the perfumes contained in the plant skin, and the action of light, which opposes this effort. He says the whole physiology of odoriferous plants depends on this principle. We may understand thus, according to M. Mesnard, why flowers are less odorous in the countries of the Orient than in our own regions: why trees, shrubs, fruits, and even pods are there sometimes full of odorous products more or less resinified; why, finally, the general vegetation there is thorny and skeletonic; for in these countries there is too much light and not enough water.—Revue Scientifique.

Street Railways in the United States.

The street railway mileage of the principal cities of the United States is:

Philadelphia	400	miles.
New York (including 100 miles elevated)	427	"
Boston (including suburban lines)	550	"
Brookyn (including 55 miles elevated)	405	"
Chicago (including 66 miles elevated)	659	"
St. Louis	291	"
Baltimore	225	"
Washington	140	"
San Francisco	231	"
Pittsburg	242	"
Cincinnati	261	"
Cleveland	192	"
Detroit	166	"
Louisville	150	"
Buffalo	146½	"

The whole street railway mileage of the United States is nearly fifteen thousand miles.—The Car.

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THE OLDS HORSELESS CARRIAGE.

The horseless carriage herewith illustrated is a compact and well proportioned vehicle which has been giving good service during the past few weeks on the country roads of Michigan. It is driven by a five horse power gasoline motor which is placed underneath the box. In attaching the motor to the carriage, care has been taken to avoid any direct attachment to the box, so that when it is running the vibrations shall not be communicated to the passengers. The carriage is steered by the operator's left hand and is thoroughly under control, the front wheels turning with something of the ease of a bicycle wheel. The starting, stopping and change of speed are controlled by a lever placed conveniently to the right hand of the driver.

To throw in the back gear the lever is thrown forward; and when turned in the opposite direction one-fourth of a turn, it throws in a four mile speed suited to rough roads or hill climbing. If a higher speed is required, another quarter of a turn gives eight miles an hour, and another quarter twelve miles. Beyond this speed the power is increased at the governor of the engine, until a maximum of eighteen miles an hour is reached. The machinery is simple in construction and is practically noiseless. The fuel supply is located below the engine, and has no connection with the box, special care being taken to prevent any possibility of explosion. The carriage is fitted with 1½ inch cushion tires, and has ball bearings throughout.

The carriage was invented by Mr. R. E. Olds, the general manager of the P. F. Olds & Son Engine Works of Lansing, Michigan.

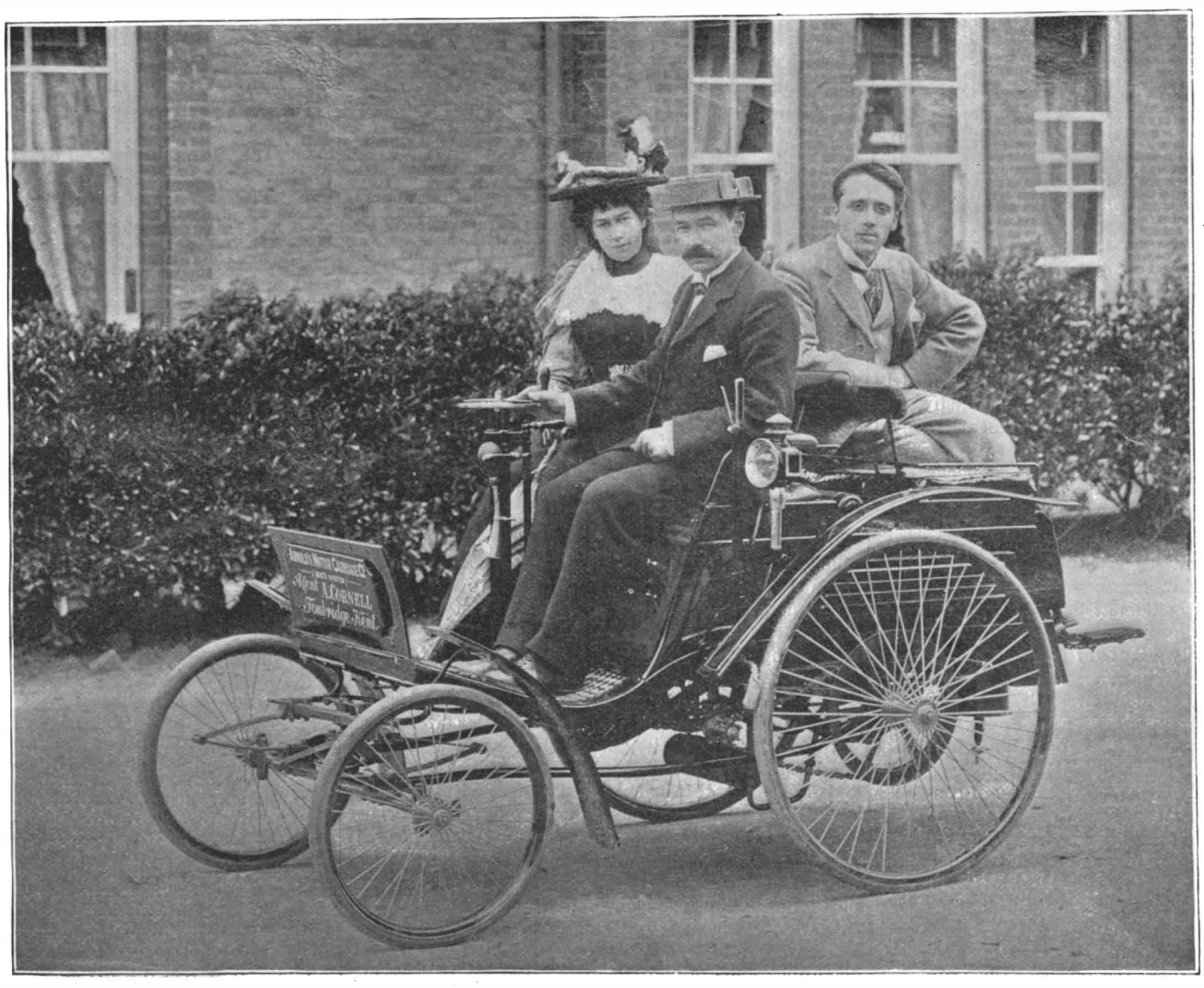


THE OLDS HORSELESS CARRIAGE.

AN ENGLISH OIL MOTOR CARRIAGE.

We present an engraving of an English oil motor carriage made by Alfred Cornell, of Tonbridge, Kent. It is known as Arnold's oil motor carriage. It is an excellent example of an all round road wagon at a moderate price—it costs £130. The carriage seats two people, but admits of a seat at the back so as to carry three people or even four people of moderate weight. The carriage is propelled by benzine, the well known Benz motor being used. The entire weight of the motor is about 500 pounds. Owing to the concentrated nature of the propelling agent, the vehicle can be run 60 or 70 miles without refilling the reservoir. The carriage itself is very pleasing in design, the wheels having rubber tires and running on ball bearings; the spokes are arranged as in bicycle wheels. The carriage is easily guided, and descends the steepest hill without using the brake, as the engine is arranged to do its own "back pedaling," as it were. The current to work the igniter is obtained from an accumulator. The current stored is sufficient to work the carriage 300 miles.

The horseless carriage has been having a hard time in England owing to antiquated laws, but thanks to sensible legislation, the industry will probably now develop rapidly. England, with its superb roads, is a splendid field for the utilization of the horseless carriage.



THE ARNOLD OIL CARRIAGE.

Siam's New Railway.

With the exception of the short narrow gage line to Paknam, the railway now under construction from Bangkok to Khorat is the only railway in Siam. It is to be the first of a vast ramification of lines designed to distribute civilization to the most distant portions of the kingdom. That the construction of the railway to Khorat should be persisted in is a matter of the highest importance to Siam. No hopes are held that the railway will pay as a commercial speculation, but hopes are entertained that, in the awakening of Siam, that fatal unsteadiness of purpose which has characterized her actions in the past may give way under better guidance to some continuity of action, and the railway, having been begun, may be finished. There is no physical reason why the railway should not be completed, and when the first engine steams into Khorat Siam will have made her best effort so far to escape from the state of semibarbarism in which she is enthralled.

The railway is 163 miles in length, and, as is well known, it is being built by Mr. Murray Campbell, one of the distinguished pioneer railway contractors of Asia, and financed by Messrs. Matheson & Company, of Lombard Street. It is designed to pierce "the center of a vast plain of magnificent soil reaching right away to the Mekong, and capable, if properly developed, of nearly doubling the present revenues of Siam." The railway is an "extremely cheap full gage line." It was to have been finished on December 12, 1895. An extension of time of one year has already been granted, and a second extension may reasonably be expected. That the railway can be ready for traffic by December, 1897, there is no doubt, for the most difficult section of the whole line will, barring accidents, certainly be completed before the end of the current year.

There have been many difficulties to contend with—a spongy soil and the alluvial plain fever and sickness in the jungle; too much water at one season; a dearth of it at another; no roads; difficulty of transport; untrained laborers; a vacillating government, and many others. The director-general of the Siamese railways is an able German engineer, Herr Bethge, who was formerly Krupp's agent in China. He was an unsuccessful tenderer for the construction of the line, the making of which he is now superintending. Inevitable friction has resulted from this opposition of interests. Constant questions are arising as to whether, for example, the subsidence of an earthwork or the wabbling of a masonry embankment is due to faults of construction or of design. Siam is a country rejoicing in a multiplicity of advisers, culled from half the nations of Europe. In the multitude of counsel, they say, there is much wisdom. — Correspondence London Times.

Books bound in the skin of departed friends are said by the London Figaro to be the fashion now in Paris. So are cigarette cases, tobacco pouches, pocketbooks, and prayer books made of the skin of notorious criminals.

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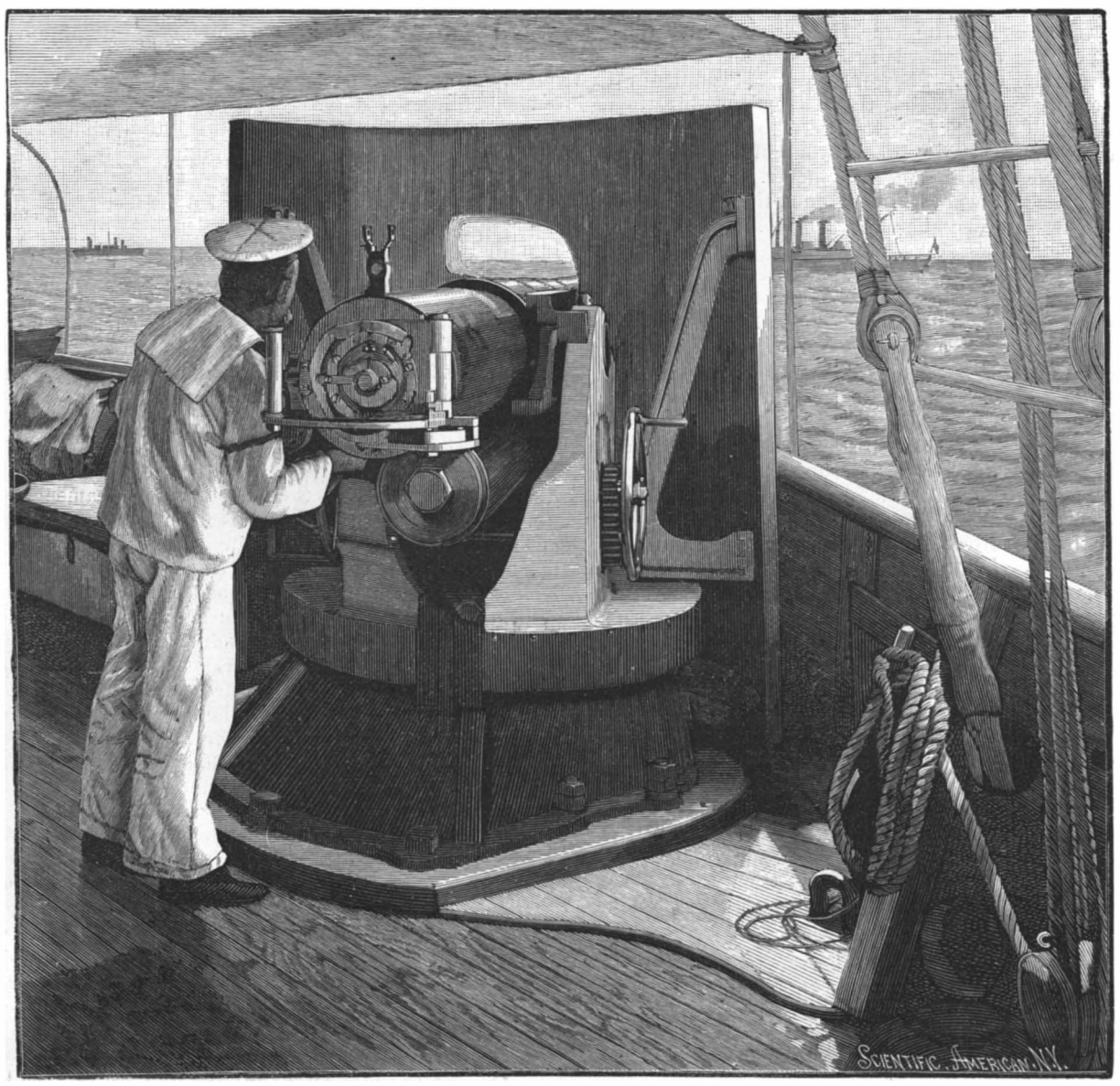
THE COAST DEFENSE MONITOR AMPHITRITE.

(Continued from first page.)

er ships. There is another monitor, the Monterey, similar in design but more modern in construction, which was built by the Union Iron Works, at San Francisco, and is now stationed at that port.

These monitors are of special interest as forming a link between the early and later systems of turret battleship construction. They embody in their original design the lessons which had been learned in the naval operations of the civil war, and, as their name implies, they are modeled after the pattern of Ericsson's famous Monitor. The chief characteristics of this type of ship are moderate speed, low freeboard, making them a difficult object to hit, thick armor, and an armament of a few exceptionally heavy guns. Sitting low in the water, they are not suited to heavy weather, and their sphere of operations lies within sheltered waters, such as are found in our bays and harbors. This is their proper sphere of action, and to enable them to maneuver in shoal waters they are designed to have as little draught as possible. Strictly speaking, they are floating batteries, and as such they are intended to cooperate with the land batteries in defense o our coasts. But though the monitor is designed specially for harbor defense, it would be quite capable of taking part in a fleet action off the coast in ordinary weather.

The Amphitrite is 259 feet 6 inches long; 55 feet 10 inches beam; and 14 feet 6 inches draught, with a displacement of 3,990 tons. The hull is built of iron and consists of an inner and an outer shell, spaced 3 feet apart and tied together by the ribs or transverse frames, and by the longitudinal girders of the vessel. The intersection of the frames and girders, whose top and bottom flanges are riveted to the inner and outer shells, forms a series of separate, watertight compartments, or "cells," as they are called, which will serve to localize the effect of the blow of a torpedo, and confine the water to the damaged portion of the ship. The double bottom rounds up into the sides of the ship and extends to within about 3 feet of the water line, where it forms a shelf upon which the side armor belt is carried. The steel belt is about 7 feet high, reaching to the main deck, 4 feet above the water line, and it is 9 inches thick amidships, tapering to 5 inches at the ends. The main deck is flush throughout the ship, except where it is broken by the superstructure and the barbettes and turrets of the big guns. It is formed of two layers of plate steel, giving a total thickness of 1¾ inches. Beneath this protective deck and behind the shelter of the continuous belt of solid steel are located the engines and boilers, the working mechanism of the turrets, and the stores of powder and shell.

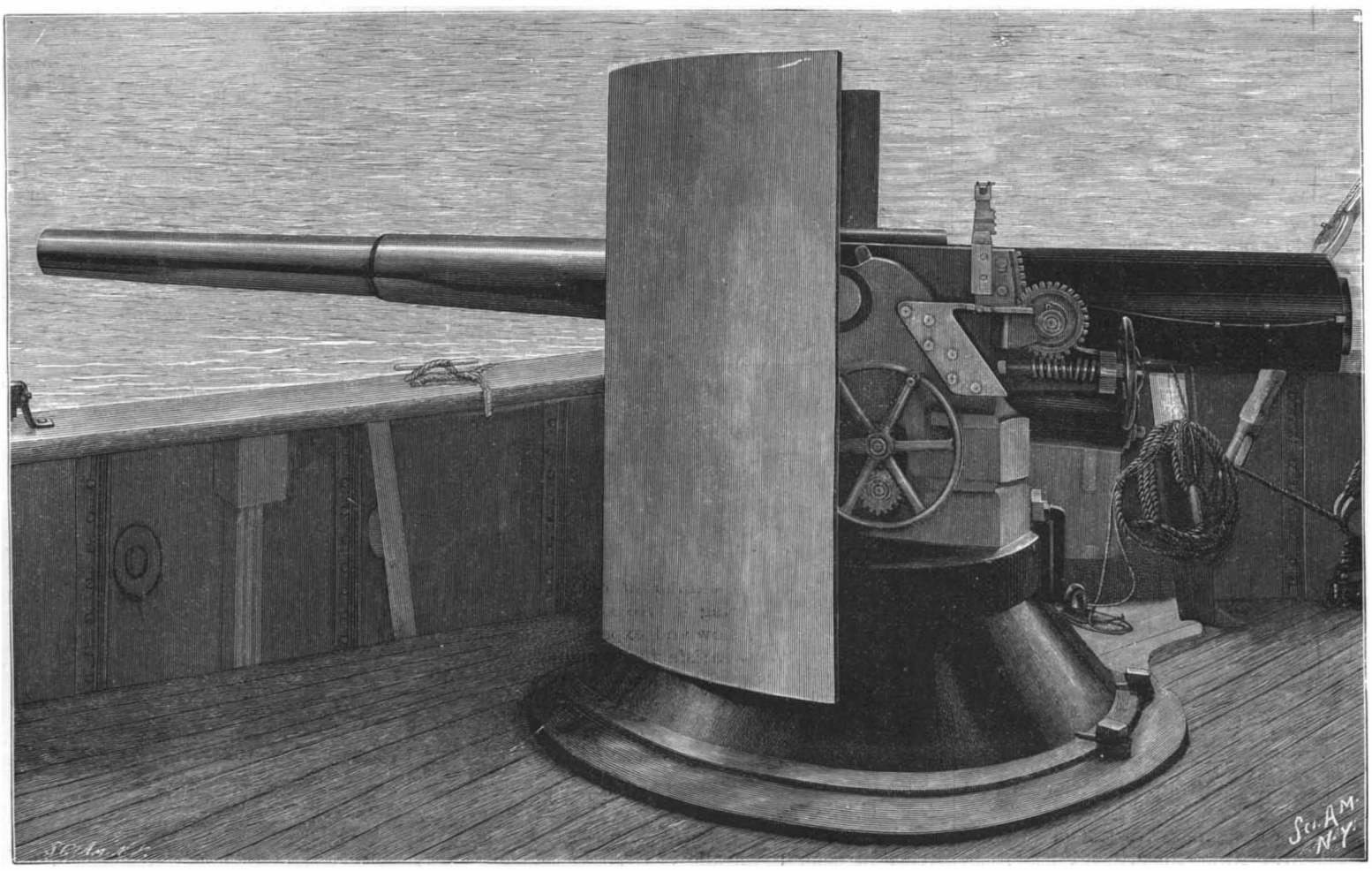


SIGHTING A FOUR INCH RAPID FIRE GUN ON THE COAST DEFENSE MONITOR AMPHITRITE.

The turrets are formed of 7½ inch Harvey steel, and their bottom edge revolves just within and near the top edge of the barbettes, which may be described as circular forts projecting 4 feet 9 inches above the main deck. The barbettes are built of Harvey steel, 11½ inches thick, and within their shelter are placed the turntables upon which the turrets revolve, and the turning gear. The protection afforded to the gun crew by the 7½ inch Harvey steel of the turret walls is further increased by a roof of 1½ inch steel which will keep out fragments of shell and the bullets from the rapid fire guns in the enemy's tops.

Just abaft the forward turret and beneath the chart house is the conning tower, with walls of 9 inch Harvey steel. It has electric and telephone communication with the handling rooms, where the ammunition is passed up to the big guns in the turrets, with the firing stations, and with the engine room. Here the captain will take up his position during an engagement, and control every movement of the ship. Above the chart house is seen the flying bridge, from which the navigation of the ship is usually carried out. Behind this is the tall steel military mast surmounted by the tops, a small circular platform, upon which are placed two Hotchkiss rapid fire guns, whose deadly hail of bullets will sweep the decks of the enemy. This will be the most perilous position on the ship, as it makes a conspicuous mark for the enemy. It is reported that at the Yulu one of the tops of a Chinese war ship was struck by a single rapid fire shell, which killed every one of the seven men that it contained.

The superstructure deck carries two 4 inch rapid fire guns, two 6 pounder, two 3 pounder, and two 1 pounder



FOUR INCH RAPID FIRE GUN WITH REVOLVING SHIELD, COAST DEFENSE MONITOR AMPHITRITE.

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rapid fire guns. We give two illustrations of the 4 inch guns, which, although they are of comparatively small size, are among the most effective and handy weapons in the navy. They are mounted on steel carriages which rotate on a circle of rollers, carried by a cast steel pedestal which is itself firmly bolted to the deck. A semicircular shield, 2 inches thick, is attached by brackets to the top carriage and rotates with the gun. The shield reaches well down over the pedestal and affords full protection to the gun mount and the crew. The gun, carriage and shield are so evenly balanced that the piece can be raised or lowered with the greatest ease. The illustration taken from the rear shows the breech mechanism, the recoil cylinder beneath the gun, and the sights. The training is effected by the crank wheel at the side and the elevation by the worm and pinion, which can be seen in the side view of the gun. The 4 inch gun fires a 33 pound shell with a velocity of 2,000 feet a second and will penetrate 13 inches of iron at the muzzle. The destructive power of this gun lies in the great rapidity of fire, which runs up as high as 20 shots per minute with a good gun crew.

The main fighting power of the Amphitrite lies in her four big 10 inch guns, which are mounted in pairs within the main turrets. This gun weighs 25 tons and fires a 500 pound shell at a velocity of 2,000 feet per second. It can penetrate 18·75 inches of steel at the muzzle, 16·82 inches at 1,000 yards, and 15 inches at 2,000 yards. The ammunition is brought up to the guns from the magazines by means of hydraulic hoists. It is placed in a cage containing three pockets, the charge in two packages being placed in the lower and the shell in the upper pocket. When the cage has been run up opposite the breech, the charge is thrust into the gun by a hydraulic rammer.

The Amphitrite is driven by the original twin screw engines designed in 1870. They are of the direct acting, inclined, compound type, and the arrangement of the cylinders and cranks is very interesting, as showing how the designers contrived to stow away such large machinery below the level of the protective deck. The cylinders which drive the port propeller shaft are located above the starboard shaft, and vice versa, the engines thus crossing each other diagonally. They are of 1,426 indicated horse power, and will drive the Amphitrite at a speed of 12 knots per hour. She carries a complement of 176 all told, and her commander, Capt. W. C. Wise, by whose courtesy we were enabled to prepare our illustrations, has the greatest confidence in this class of ship, his conviction being based upon his practical experience of the monitors during the naval operations of the civil war.

Corn Pith Cellulose.

The annual meeting of the Society of Naval Architects and Engineers, begun November 10 at 12 West Thirty-first Street, New York City, brought together a distinguished gathering of marine architects and naval constructors, who listened with interest to the reading of a number of papers upon naval and maritime subjects by acknowledged authorities.

The first business transacted was the election of officers of the society for the year 1896-97. Clement A. Griscom, president of the International Navigation Company, succeeded himself as president. Naval Constructor Frank L. Fernald was elected a vice-president, to serve with nine others who were re-elected.

The paper that created the widest interest was that read in the afternoon by Henry W. Cramp, of the shipbuilding firm of William Cramp & Sons, on "American Corn Pith Cellulose." Marine engineers understand by corn pith cellulose a substance similar in appearance to ground cork that is packed behind the armor of a vessel or at the edges of her protective decks. When a hole is shot in the armor or deck and the water enters, the corn pith cellulose swells and closes up the hole so effectively as to stop the leak entirely. According to Mr. Cramp's paper, the corn pith is an American invention, and like most American ideas in naval construction, is superior to the cellulose made of cocoa fiber that has been used by the French naval constructors for a similar purpose.

Cellulose has been used in the construction of the New York, the Columbia, and the Olympia, and Mr. Cramp recommends its use for all further vessels that may be built by this government. Of the naval tests of the American improvement in cellulose, Mr. Cramp said:

"The cellulose at first used by our Navy Department was manufactured in Philadelphia. It was made of the husks of cocoanut; the cellulose proper looking like bits of ground cork, being separated from the fiber by specially built machines, and after certain processes intended to preserve it from decay and render it incombustible, it was packed in cofferdams mixed with a certain amount of fiber to hold it together. The tests to which this cellulose was subjected in our navy were such as to produce an article superior to that made in France.

"In order to make a comparative test of this new corn pith cellulose, the Navy Department made two cofferdams of steel plates, stiffened by angles, 6 feet high, 6 feet wide and 3 feet thick. In one was placed 832½ pounds of cocoa cellulose and fiber mixed to the usual proportions, corresponding to a density of 7·7 pounds to the cubic foot. The other cofferdam was packed with corn cellulose containing 702 pounds, corresponding to a density of 6·5 pounds per cubic foot. These cofferdams were sent to the Indian Head proving grounds and were fired at on June 10, 1895. The first shot was fired at the cocoa cofferdam. A 6 inch shot, having a velocity of 1,000 feet per second, was fired into the cocoa cellulose with a gun at a distance of 314 feet. The hole made at the point of entry was the diameter of the shot and that at the point of exit at the rear of the cofferdam was an irregular jagged hole 7½ by 8½ inches. Water was applied to the front of the cofferdam, the level being five feet above the hole. In ten minutes the first drop of water appeared through the hole. The flow increased gradually, and in a few minutes had become comparatively steady, running about twelve gallons in one-half hour. The flow of one-half gallon a minute then became approximately constant.

"In the meantime the cofferdam containing the corn cellulose was fired at under similar conditions. Water was turned on as before and left for one and a half hours, during which time no water whatever appeared at the hole in the rear of the cofferdam, nor at the end of the time had the corn cellulose at the mouth of the hole in the rear become damp. The cofferdam containing cocoa cellulose was then fired at with a 250 pound 8 inch shell, at the same distance and with the same velocity as that of the 6 inch shell. The water was then turned on with a head of about five feet, as before. In twenty-five seconds a few drops appeared at the hole in the rear, and about twelve gallons had passed through in thirty minutes. Under similar conditions an 8 inch projectile was fired at the corn cofferdam. The water was turned on, and after waiting forty-five minutes no water appeared at the hole in the rear of the cofferdam, nor was the corn at the rear damp. No water had appeared at the 8 inch hole which had previously been made, nor was it damp at the completion of the experiment."

To Experiment with Different Alloys for Coinage.

In the short period that will elapse before Congress convenes again in December a series of interesting experiments in coinage will be conducted at the mint in this city, says the Philadelphia Record. Metals and alloys heretofore untried for the purpose will be tested and stamped into token coins. Their availability as substitutes for the alloys of which the minor coins—nickels and cents—are now made will be ascertained and samples submitted to Congress.

Of all the countless possible alloys to be obtained from copper, tin, nickel and aluminum in different combinations, perhaps fifteen or twenty may be found fairly satisfactory. It is possible that one or two of these may advantageously be brought into use for general coinage. No fault has been found with the present one cent and five cent pieces. The experiments are merely ordered to keep in touch with the times and to gain a knowledge of resources. The Philadelphia mint, while having no experimental department, is well equipped to make the tests.

Aluminum, which has never yet found a place in the currency of any nation, is to be worked up into trial coins. It is also to be given a chance in new alloys. Aluminum is a metal of which but little has been known until recently, and it has been found useful in so many ways that a sort of popular idea prevails that it would be good for coins. Chief among its advantages would be its very light weight. Cents made of it could readily be distinguished from coins of the same size by this remarkable lightness alone.

Dr. D. K. Tuttle, the chief refiner at the mint, who knows all about the properties of metals, is somewhat skeptical, however, as to whether aluminum will come out of the proposed test with flying colors. It is extremely difficult to anneal, and when heated will suddenly run like butter instead of becoming plastic. There would be trouble in rolling it into the long strips from which disks are cut preparatory to stamping. Of course, it can be worked, but not with sufficient ease and rapidity to make it practicable for coining on a large scale.

Pure nickel has recently been coined in Switzerland, but it has been found just as difficult to handle as aluminum, though for a different reason. Such great heat is necessary to bring it into condition for coining that the operation is slow and expensive. While pure nickel coins might be satisfactorily made in the mints of Switzerland, it does not follow that the same would be true at the Philadelphia mint, which is called upon to turn out fifty times as many 5 cent pieces as the mints of that country, and could not spare the time to work over them.

The 5 cent coin now in use contains only 25 per cent of nickel, the remaining 75 per cent being of copper. Nickel, more than any other metal, has the property of giving its color to an alloy. Even an alloy of 90 per cent of copper and 10 per cent of nickel will be nearly white. The advantage of using a greater proportion of nickel in the 5 cent piece is therefore not apparent, especially as more than 25 per cent of it makes the alloy refractory.

The experiments at the mint will include different combinations of nickel, copper and zinc, forming the alloys known under the head of German silver; copper and tin, which produce bronze; aluminum and copper, which make aluminum bronze. German silver has been used for coins by one of the small South American states, and proved fairly adapted for the purpose. Bronze is commonly used for coins of small value. It is doubtful if aluminum bronze in any form will be found acceptable, as it is hard to work, and has a yellow, brassy appearance, resembling gold, which is to be avoided in all coins of small denomination.

Statistics of the Sea.

The statistical summary of vessels totally lost, condemned, etc., shows that during 1895 the gross reduction in the effective mercantile marine of the world amounted to 1,237 vessels of 806,278 tons, excluding all vessels of less than 100 tons. Of this total 310 vessels of 372,463 tons were steamers, and 927 of 433,815 tons were sailing vessels. These figures exceed the average of the preceding four years by 62 steamers of 81,519 tons and by 55 sailing vessels of 42,940 tons.

As regards steamers owned in the United Kingdom, the return is also above the average, while as regarding sailing vessels it is somewhat below. The increase in the case of the former is due, not to actual wrecks, but to the large tonnage broken up, condemned, etc. Apart from such cases, the United Kingdom steam tonnage lost during 1895 is only equal to the average of the last four years, notwithstanding since 1891 the tonnage owned was increased by 1,500,000 tons.

The summary exhibits interesting data as to the relative frequency of the different kinds of casualty, etc., which conclude the existence of vessels. Strandings and kindred casualties, which are comprised under the term "wrecked," are much the most prolific cause of disaster. To such casualties are attributable about 40 per cent of the losses of both steamers and sailing vessels. The next most frequent termination of a vessel's career is by condemnation, dismantling, etc.; 20 per cent of the vessels removed from the merchant fleets of the world are accounted for in this manner.

Of the remaining causes of loss, collision is the most general for steamers (16 per cent), and abandonment at sea for sailing vessels (15 per cent). Cases of abandoned, foundered, and missing vessels may, perhaps, be regarded as frequently more or less similar in the circumstances of loss. If these be taken collectively, they comprehend 18 per cent of the losses of steamers and nearly 30 per cent of the losses of sailing vessels. The percentages here given are based on the present return alone, but the order of frequency of the several classes of casualty appears to be normal.

The return has been compiled in such a manner as to enable a comparison to be made between the percentages of loss suffered by each of the principal merchant navies of the world. Great as the absolute annual loss of the vessels belonging to the United Kingdom appears to be, it is seen to form a very moderate percentage of the mercantile marine of the country and to compare favorably with the losses sustained by other leading maritime countries. The merchant navies which exceed a total of 1,000,000 tons are those of the United Kingdom, the British colonies, the United States of America, France, Germany, and Norway.

Of these countries, the United Kingdom shows the smallest percentage of loss, viz., 3 per cent of the vessels and 2·4 per cent of the tonnage owned; the British colonies follow, with 3·4 per cent of vessels and 3·7 per cent of tonnage, and Norway is the highest, with 7·4 per cent of vessels and 6·5 per cent of tonnage. As regards steamers, the percentage of loss for the six countries is 2·5, while the percentage of the United Kingdom stands at 2·33. For sailing vessels the six countries give a percentage of 6·3, as compared with 4·5 per cent for the United Kingdom.—London Times.

A Horse Cycle.

President L. S. Woodbury, of the Great Falls Iron Works, Montana, says a Western contemporary, has in contemplation the construction of what he chooses to term a horse cycle, whereby a horse can propel a four-wheeled vehicle on ordinary ground at the rate of one mile in fifty-nine seconds. The proposed machine can be made in two forms, either one of which Mr. Woodbury thinks will fill the bill.

The first is in the form of an ordinary buggy. Instead of being hitched ahead, the horse will occupy a position between the four wheels and operate a sort of treadmill. Should the velocity be so great as to attract too much air, then it is proposed to inclose the entire machine—horse, rider, and all—in a whaleback or torpedo-cut shell, the propelling operation to remain the same. The seat of the rider will be directly behind or above the horse. President Woodbury is so confident of success that he is willing to back his bonds against silver that a mile can be made in fifty-nine seconds or better.

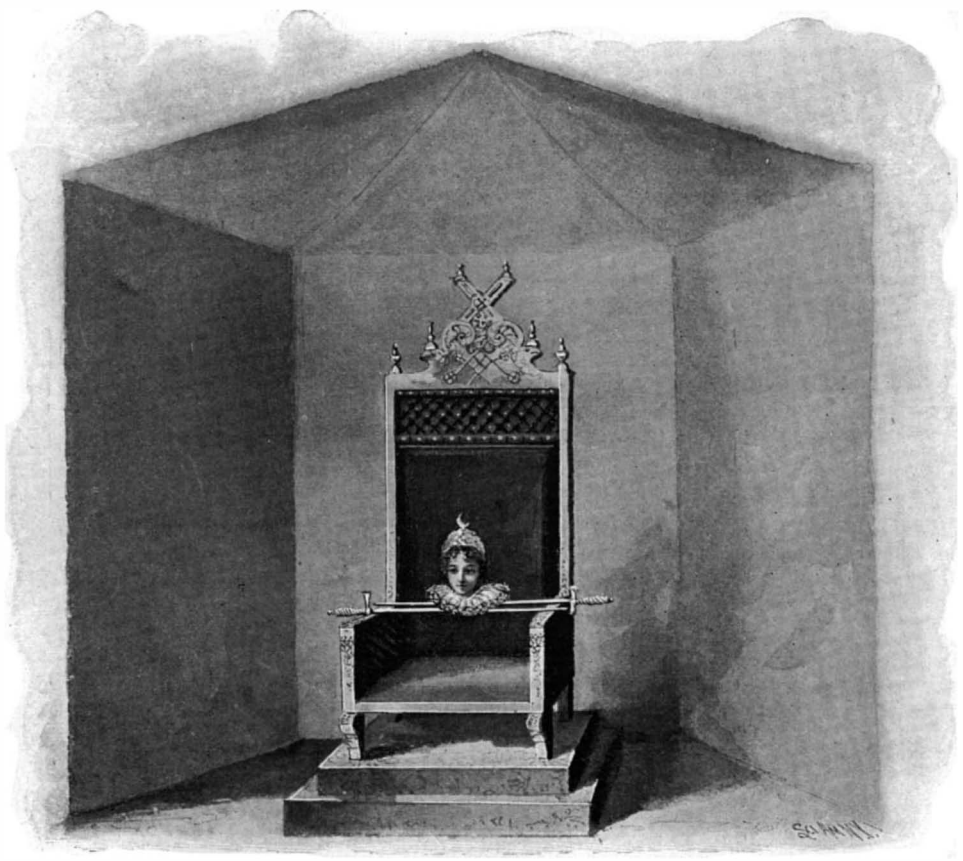
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THE DECAPITATED PRINCESS.

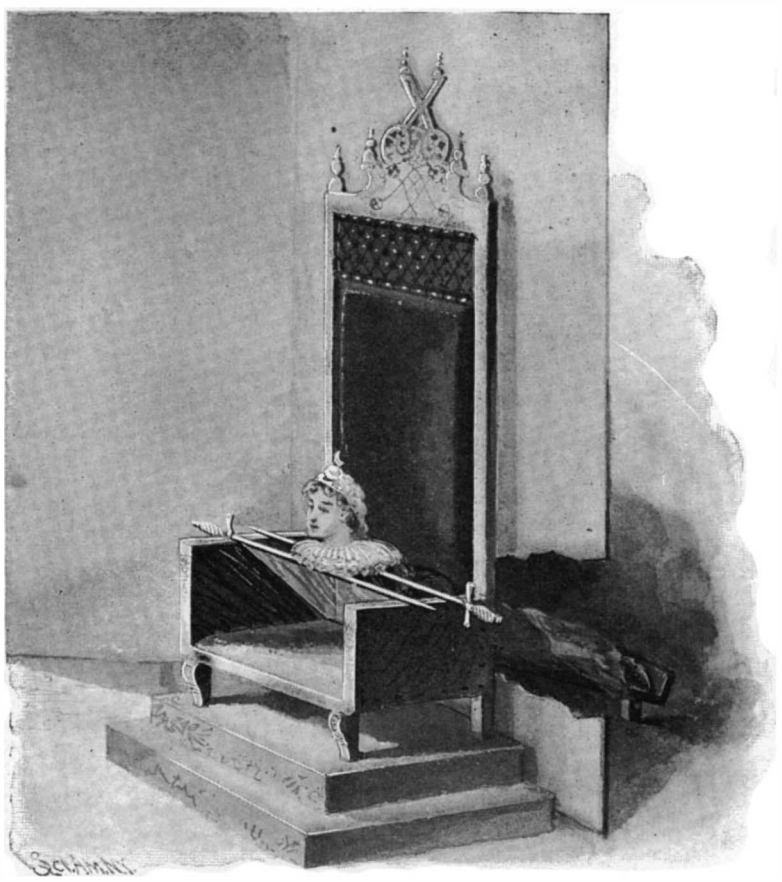
Among the few really successful illusions presented in France in the last few years, the one called the decapitated princess succeeded in mystifying the public most admirably. On entering the room in which the illusion is exhibited, the spectators see a curtained recess, within which is a beautiful chair resting on a raised platform, with two swords lying across the arms of the chair and a lady's head resting on the swords, as shown in one of the views. The illusionist states that this is the head of an Egyptian princess who was accused of treason and beheaded. This gentleman relates a very interesting little story about the princess, how the head retained all of the faculty of the living after being separated from the body, and was placed on the throne chair in which she would have soon taken her seat as ruler of her people if it had not been for the accusation of treason, and how he secured possession of the head.

Regardless of this story the spectator knows he is looking on nothing but a clever illusion. The chair is upholstered in red plush and is placed close to the curtain at the back of the recess. At the back of the chair is an opening just below the level of the tops of the chair arms. This opening is not seen from the front, as it is concealed by a mirror that is placed between the arms of the chair at an angle of 45°. The ends of the mirror rest in folds of the fan-shape upholstering on the inside of the chair arms. The lower edge of the mirror is resting on the bottom of the chair and the upper edge is concealed by laying one of the swords on it, as may be seen in the other illustration. At the proper angle the bottom of the chair is reflected in the mirror, leaving the impression that one is looking at the back. The folds in the upholstering of the inside of the arms effectually conceal the ends of the mirror. There is a hole in the rear curtain directly opposite the hole in the chair back, through which there passes a board supported at one end by resting on the seat of the chair and at the other end by a small box or any convenient article.

The lady who is to impersonate the princess takes her position on this board with her chin just above the edge of the mirror, the second sword is placed at the back of her head and a wide lace collar that she wears around her neck is adjusted so as to rest nicely on the two swords. The second illustration shows the board in position passed through the curtain, with the lady lying on it, her head on the swords and the lace collar in position. The curtain in the rear must be close to the chair, but the side curtains are removed about five feet. The board is padded so as to make the lady as comfortable as possible when on the board.



ILLUSION OF THE DECAPITATED PRINCESS.



THE DECAPITATED PRINCESS—EXPLANATION OF ILLUSION.

Animals' Change of Color in Cold Countries.

As winter approaches and the green of summer is replaced by snow and ice, a peculiar change occurs among certain animals. At the first hint of cold they begin to assume a different color; tints of gray and lighter hues appear in the somber black or dark coat of summer, and soon the animal is mottled with dark and white patches, finally becoming a pure white, that is at once a protection, rendering it almost invisible on the snow. Before the change was understood it was supposed that the animals were distinct forms, one white and the other dark. But it is now well known that a number of animals change their color with the regularity of the seasons, says the Philadelphia Times.

One of the most interesting examples is the hare, several of which are known to assume a winter pelage, the most familiar being the varying hare and the Arctic hare. The latter in summer, when it would in a winter coat present a marked and striking contrast to its surroundings, is on its upper side black and a light brownish yellow, mixed; the upper portions of the tail and the tips of the ears black. This color is retained all through the summer, but at the approach of the cold season the pelage begins to fade and gradually becomes white, with the exception of the tips of the ears, which remain black.

This wonderful changeable hare is found in the Alps, Ireland and Scotland, and in the Arctic regions of Asia. In many of the Arctic explorations it has been of the greatest service to the men from its habit of frequenting camps. The voyagers of the Vega often relied upon the little animals in time of need and when food was scarce.

In America, in the far north, we have the same hare, but a larger and finer animal, known as the polar or glacier hare. The American form ranges from the north to the middle portions of the country, and in regions away from the extreme north changes only slightly or imperfectly. As the cold comes on, its dark coat fades to a lighter hue, becoming pronounced in summer again.

The protection afforded these animals in the far north is almost perfect, as it is almost impossible to distinguish them from the snow. When they run they seem to be swallowed up in the field of white.

The principal four-footed enemy of the white hare is the Arctic fox, that is endowed with a similar protection. It is one of the smallest foxes known, and certainly one of the most beautiful. In summer, when the ground is bare or covered with verdure, the little animal has a silky fur, bluish or brownish gray. This lasts until the snow comes, when the coat gradually changes. The hair becomes longer and thicker, especially on the tail and feet, which are densely furred, and by midwinter, or before, it is pure white, without a suspicion of its summer hue.

If the winter and summer pelage be contrasted, it will hardly seem possible that they represent the same animal. The fox is a very cunning and intelligent creature, as all Arctic travelers have discovered. It is an inveterate thief, stealing for the pleasure of stealing, taking from the Vega explorers not only food, but knives, forks, ammunition, sacks, shoes and stockings. When the men slept they would crawl under the robes and nose them, and if those awake held their breath, pretending to be dead, the foxes would begin to nibble them, and when frightened off would carry away a hat, mittens, or anything that came in the way. If followed, one of the foxes would go on guard while the others buried the stolen goods.

The ermine, whose fur has become fashionable again, is a familiar example of this remarkable change in color. It is common in all the northern countries and in our own country down to the Southern States, a most destructive little creature, killing chickens, birds and various animals, often simply for amusement. An ermine has been observed watching a bird, placing itself beneath an inviting roost; when the bird alighted it sprang at it, clinging to it, although carried a long distance into the air.

Some curious experiments have been tried with this little animal. Four or five were caught one summer in the north and found to have rich coats of a mahogany brown color. Two were sent to some one in the Southern States, while the remainder were kept where the cold winter prevailed. Those in the north began to change as the leaves disappeared, the strange painting of nature gradually going on until the animals, with the exception of the tip of the tail, were pure white. Correspondence has been kept up with those having the other ermines in charge, but in vain they looked for the winter change. The animals retained their mahogany-colored coat during the warm winter, showing conclusively that the change is produced by the cold, and is a wise provision of nature, rendering the animals almost invisible to their enemies.

There is another reason given for the change—a wise provision of nature to protect the ermine from the cold. Animals with black or dark colored fur radiate internal heat more effectually than those of lighter colors; so the ermine in its white coat absorbs the rays of the sun, radiating but little; thus the change becomes an important factor in the preservation of the heat supply. In their movements these animals and their allies resemble serpents, and the actions of an ermine stealing along with sinuous motion over the snow are very suggestive.

Temperature of the Polar Sea.

Some of the members of the Nansen expedition at Tromsoe have been relating to a Reuter's correspondent some of the scientific facts gleaned during the expedition. During the course of the cruise the crew had on several occasions exciting encounters with bears. North of 84°, however, no animal life was found to exist, and this would seem to cast some discredit on the hitherto prevalent theory that if a sufficiently high latitude could be attained one would come to dry land and open water, because birds are to be seen flying toward the extreme north. This northerly flight of the birds is now believed to be attributed to their having lost their way or as being blown out of their course. The depth of the water in the extreme north also seems to indicate that there can be no land near. Soundings taken at 84 latitude gave a depth of from 1,310 to 1,530 fathoms, and further north the lead reached even greater depths, as much as 3,186 fathoms, it is said. From observations made in 1894–96, the temperature of the sea in these regions was found to present several peculiarities. At a depth of 109 fathoms the water was cold. Then came a stratum of about 382 fathoms with some degree of heat, and under this stratum about 490 fathoms of cold water. The proportion of salt in the water varied a good deal. These conditions were pretty much the same everywhere. The further north they got the less current and tide there was, while the wind began to exercise considerable influence on the course of the Fram.

THE passage has now been opened from end to end of the new Blackwall tunnel.

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RECENTLY PATENTED INVENTIONS.

Engineering.

EXPANSION STEAM TRAP.—Hubert F. Smurthwaite, Coatesville, Pa. This is a trap arranged for convenient adjustment to be set for automatic action at any desired pressure, the trap being readily cleaned of sediment whenever desired. Secured at one end in a suitable frame is an expansion tube connected with the steam supply, a discharge valve on the other free end of the tube having its stem fitted to slide in a stuffing box attached to the valve body, the latter sliding in the frame, and on the frame is fulcrumed a lever holding on its free end a bolt engaged by a spring to give the desired t nsion to the bolt, lever and valve. If set to two hundred pounds pressure, the trap will work as well as at five pounds pressure, and it may also be readily used as a relief valve for steam engine cylinders.

SEPARATOR.—Alphonse F. Gaiennie, Lafourche, La. This invention is for an improvement in separators employed in connection with vacuum pans, to separate and collect the vapors and minute particles of liquid carried, being also adapted to separate oil and grease from exhaust steam. The separator has semicircular baffle plates extending transversely across the drum, and having angular bends at their free edges forming passages, whereby the vapors are caused to follow a sinuous path, each plate serving to partly dry the vapors. If desired, the passage through which the vapors flow may be made narrower at the inlet and gradually widened toward the discharge end.

Railway Appliances.

CAR FENDER.—Rudolph C. Hoyer, Memphis, Tenn. This is an improvement on a formerly patented invention of the same inventor, simplifying its construction, and providing means whereby an under or receiving fender has a rearward movement upon striking an obstacle, and immediately sets in operation a rocking or upper member, the latter being held stationary beneath the car when its services are not required. The upper member, or raking fender, when an object is struck by the receiving fender, moves forward and downwardly until its cushioned edge strikes the ground, when it has a rearward and upward movement, carrying upon the receiving fender any object met with in the path of the car.

Electrical.

TELEPHONE SWITCH.—Christian N. Sandbeck, Harmony, Minn. This invention provides means by which two telephones in a series may be placed in connection without preventing other telephones in the series or on the line from being put in communication, while conversation between two telephones cannot be heard through other telephones in the same circuit. In a suitable casing is a pivoted lever adapted to close electric connections, contact springs extending transversely in the box and adapted for engagement with contact fingers, while spring plates in the casing are adapted for engagement with other contact springs, and to force the respective fingers into contact with their contact springs. The inner ends of push pins have loose engagement with their respective plates.

Mining, Etc.

MINER'S SAFETY LAMP.—Thomas H. Williams, Mount Carmel, Pa. This is a lamp designed to be very sensitive to mine gases, and is arranged to prevent relighting by the miner, who must go to an authorized person having the proper key to have the lamp lighted. An inverted cup with an aperture in its bottom has at its lower end a flange screwing into the lamp body, while a flanged sleeve engages the bottom of the cup, the sleeve extending through the aperture and forming a passage for the wick tube, a locking device on the cup engaging the sleeve.

DRY ORE CONCENTRATOR AND SEPARATOR.—Robert E. and Eugene Waugh and Charles S. Older, Colorado Springs, Col. According to this improvement a box frame having an air chamber is supported in a main chamber, and over the air chamber is operated an apron adapted to permit the passage of air through it, air pressure being produced in the chamber and the box being given a circular movement, whereby the material, as it is agitated by mechanical movement, will be lightened and opened up by the air pressure. The material to be treated is first dried in a kiln, then fed successively to a rock breaker, to Cornish rolls, and a disintegrator, whereby it is pulverized, comminuted and triturated to the desired degree of fineness, and the separation of the particles of value is effected through the action of the air through the meshes of the moving apron and the gyratory movement of the suspended box.

Mechanical.

SELF-OILING JOURNAL BEARING.—David L. Altman, Eau Claire, Wis. This bearing comprises an elongated box in which is a central vertical oil well communicating with the box by a horizontal channel, and the upper portion of the well communicating with outwardly extending passages and filtering chambers. The box also has a bore communicating with the filtering chambers and two dust chambers, and fixed to the shaft revolubly mounted in the bore is a feed wheel revolving in the oil well. The lubricant may be used continuously for considerable time without refilling the well, and it is wholly immaterial in which direction the shaft is run.

NUT LOCK.—Emile Fluehr, Sprague, Washington. According to this improvement, the nut is made with a groove across its thread and a shallow recess in its outer surface extending from the thread to one corner, a key or locking bar adapted to be removably fitted in the groove having a triangular cross section in its body and two angularly extending spring limbs at its outer end. In the recess at the corner of the nut is a detent hook, and when the key is inserted and one of its spring limbs brought into engagement with the hook, the edge of the body of the key is made to bear with force upon the threads of the bolt.

VALVE.—Sidney W. Sampson, Hudson, Mass. This valve is made with an operating mechanism for raising it from or lowering it to its seat gradually, permitting it to be also readily adjusted or quickly reversed in position. The valve has a stem screwing in a nut with which is connected a pivoted lever arranged to move both the nut and the valve stem, the lever being located and operated either above or below the valve.

GRINDING MACHINE.—Frank Parsons, Montgomery, Miss. This is a machine especially adapted for evenly and uniformly grinding and sharpening the cutter heads of planing machines with economy of time and labor. The machine has an adjustable sliding carrier to hold the cutter head to be ground, means for actuating the carrier and an adjacent grind wheel adapted to engage the cutter head, the latter being placed at various angles to or parallel with the wheel according to the angle on which the cutting edges are to be ground.

MEANS FOR TRANSMITTING MOTION.—William C. Douthette, Pittsburg, Pa. This is an improvement especially adapted for application in connection with steam pumps, the invention providing means whereby the reciprocation of the piston rod causes the pulley or balance wheel to turn, including two pulleys or balance wheels, and devices between them and the piston rod by which to turn the pulleys or wheels in opposite directions. Certain improvements are provided in the intermediate devices between the rod and the pulleys or wheels, and the two balance wheels equalize the strain, balancing each other.

Agricultural.

HAY LOADER.—John T. Hare, Fresno, Cal. This inventor has devised a loading device to be attached to a wagon to take hay or straw from the ground and deposit it in a basket or on the body of the wagon, the elevator of the loader being driven from the wagon axle and the elevator not interfering with the animals drawing the vehicle. The elevator or conveyer is made to be folded up out of the way when not in use, and a net is provided for the body of the vehicle, for the reception of the grain or straw, so that when the load is to be discharged it may be lifted bodily by simply raising the net and dumping it wherever desired.

BALING PRESS.—Elias H. Butts, Oriental, N C. This is an inexpensive press for baling hay by hand. The baling is effected in an upper box, and a lower box receives the material, a platen in the lower box having downward side extensions and a series of ladder-like connecting bars to form a follower, while detached hand levers fulcrumed on a fulcrum bar operate alternately on the ladderlike bars of the follower. The press may be easily constructed in any ordinary workshop, and it has a capacity of ten bales per hour.

FRUIT BOX.—Eben R. Morrill, Truckee, Cal. This is a box in which fruit may be conveniently packed and the cover and bottom secured in position without the employment of special fastenings, as nails, catches, etc. The sides rigidly connect the ends with each other, and the latter have on their inner faces undulating grooves, the straight tops and bottoms being adapted to be pushed in and drawn out of the grooves. The bottom of the box is placed some distance above the floor or ground, and is sufficiently springy to counteract jars in transportation, and prevent undue pressure upon and spoiling of the fruit.

Miscellaneous.

VELOCIPEDE.—August Miller, Lindsborg, Kansas. This inventor has devised a unicycle designed for traveling on land or water. The wheel has a ring hub within which is the operator's seat, and the exterior of the hub is toothed, while in a frame having rolling connection with the hub are journaled pedal shafts with gears. To adapt the unicycle for marine use a pontoon is connected with it, having a central channel to receive the traction wheel and a locking connection at each side, the pontoon being of dished structure and preferably of somewhat circular shape, and the traction wheel having paddle-like spokes.

BARREL FILLING MACHINE.—Johnston E. J. Goodlett, Memphis, Tenn. This invention relates to devices which have a valve attachment to cut off the flow of liquid when a receptacle is filled to the required limit. According to this improvement a valve is arranged in a chamber of the discharge tube, the valve having a transverse axis to one end of which is attached a coiled spring with adjustable tension, and the valve lever being adjustably connected with a slotted sector, and being also connected with a trip and float mechanism.

HOSE NOZZLE.—Charles Hirsch, Buffalo, N. Y. This is a nozzle designed to readily control and regulate the discharge of water, throwing either a plain stream or a spray, or cutting off the water entirely if desired. The nozzle has lateral openings and a closed outer end from which projects a spherical lug or ball, a tip or nipple screwing on the end of the nozzle, and regulating the flow of water. The device is simple and inexpensive, and readily adjustable for the required service.

CEILING PLATE.—John Scringeour, Jr., Pittston, Pa. This plate has a cylindrical body portion with an outwardly projecting flange at its lower end, a spring arm secured to the body tending to engage the flange. The plate is formed in two interlocking sections, and is adapted to hold itself in place and effectively protect the ceiling from a pipe passing through the plate.

DUST PAN.—Albert Koehler, Baker City, Oregon. This is a device designed to retain the dust made by the broom and prevent its rising and settling on the furniture. It is made in the form of a box having double walls of wire cloth to permit the passage of air currents formed by the movements of the broom, the walls being separated by a space designed to form a trap to receive and retain the dust.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7022) A. C. K. says: 1. Please give me formula for making the best leather cement, such as is used by shoemakers for putting patches on. Most cements for this purpose contain the objectionable smelling bisulphide of carbon and are dark colored. These are objections. Can you give me recipe for a cement free from this nasty smell and which is white and transparent and equally good? A. Try bicycle tire cement; apply to both surfaces in several coats, letting it dry thoroughly between applications and after. Then put patch in place. 2. Is there any work published which thoroughly treats on the metal zinc, as used for galvanizing purposes? A. See our SUPPLEMENT, Nos. 967, 176, 994, mailed for 10 cents each.

(7023) J. S. W. asks for a formula for making a good quality of paste such as bookbinders use. A. 1. Water, 1 quart; alum, ¾ ounce. Dissolve, and when cold, add flour to make it of the consistence of cream, then bring it to a boil, stirring it all the while. Preserve with a few drops of carbolic acid or oil of cloves. 2. (Hard.) To the above add a little powdered resin and a clove or two before boiling. This will keep for twelve months. When dry it may be softened with water.

(7024) P. B. writes: We have had an X ray outfit on exhibition here for the last month. We wish you would please tell us if in your opinion the rays will affect one's fingers and eyes, for one of our operator's eyes has become inflamed, and one of our young operator's fingers has become black and numb. Please tell us if this is caused by looking at the rays. A. We are inclined to believe that the troubles you mention are caused by the X rays; similar cases have been reported abroad, the hair being usually injured.

(7025) T. P. asks: 1. What is the best non-conductor of heat (wood excepted), which is either a solid like wood or can be made to cover a solid? A. Of ordinary stable substances, probably magnesia is as good as any. Silica, asbestos board and fiber are good. 2. What is best absorbent for liquid dropping a few drops at a time, say 10 or 15 in all? A. Any absorbent solid, such as dry clay. Quicklime will absorb water, combining with it chemically, but evolving heat, and slaking by the moisture of the air.

(7026) F. H. asks: 1. How many bichromate batteries will it take to light 10 one candle power lamps? Also 15 one candle power lamps? A. It depends on the resistance of the battery. Taking this at ¼ ohm and voltage at 1.75, we have 13 cells for ten lamps and 20 cells for fifteen lamps approximately. 2. Is bichromate a good battery to use for the above purpose? A. It is about the best of the primary batteries. All are expensive and troublesome in operation. 3. Also give a simple rule for figuring out how many batteries it will take to light a certain amount of lamps. A. You will find the following a good general rule: Multiply together the current of the battery on short circuit by its voltage. Divide 16 by the product to get cells per candle power. In Sloane's "Arithmetic of Electricity," $1 by mail, you will find several rules to cover different cases.

(7027) G. B. asks: I wish to know if there are any reliable statistics to be obtained, and where, as to the actual saving in the use of 16 candle power electric lamps over gas. What I mean is, Does it pay to put in a plant to make your own light, say I should want 1,000 sixteen candle power lamps, and yet I am able to buy gas at $1.50 per 1,000 feet? A. Allow ten sixteen candle power incandescent lamps to the horse power. Allow five feet of gas per hour to produce 16 to 20 candle power. This gives the basis for calculation. 1,000 gas burners would represent $7.50 per hour. Generally, incandescent lamps are supposed to cost more than gas.

(7028) E. M. asks if fine thin tea lead, such as package tea comes in, will do for making a condenser for a 3 inch spark coil, and how much surface he will have to have. A. Yes; make the surface twice as great as that described for the coil in our SUPPLEMENT, No. 160.

NEW BOOKS AND PUBLICATIONS.

ROENTGEN RAYS AND PHENOMENA OF THE ANODE AND CATHODE. By Edward P. Thompson, M.E., E.E. Concluding chapter by Prof. William C. Anthony. New York: D. Van Nostrand Company. Pp. 190, 105 illustrations. Price $1.50.

This carefully written book enters into the experimental development of X ray phenomena. It begins with the early researches of Faraday and follows the subject down to the present time, giving a resumé of the important experiments, and presenting the various theories. It presents a few typical applications of X rays in anatomy, surgery, diagnosis, etc., and is, in fact, a book of great interest to students of high vacua phenomena, especially such as relate to the discovery of Roentgen.

LOCOMOTIVE MECHANISM AND ENGINEERING. By H. C. Reagan, Jr. New York: John Wiley & Sons. Pp. 420. Price $2.

This is a second edition, revised and enlarged, of a work by a practical locomotive engineer, who has endeavored to describe the manner in which the locomotive is handled while in service. To do this best, the engineer should have something more than an elementary knowledge of its construction, that he may, where breaks occur and repairs are made, be able to judge of the work necessary and how best to do it. There is a chapter on compound locomotives and an appendix on the modern electric locomotive.

A book of tables of dimensions, recently published by the Walworth Manufacturing Company, of Boston, exhibits a great amount of careful calculation as to the best proportions of different parts of various sizes of valves and fittings made by the company. The company manufacture, as specialties, the Walworth extra heavy and standard weight gate valves, and the Walworth extra heavy and standard weight fittings, and wrought iron pipe bends of all descriptions for high or low pressures. The use of these bends in place of sharp elbows or angles, wherever possible, is a matter not to be neglected by engineers or steam users.

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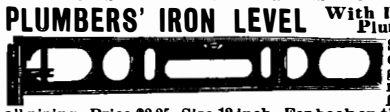
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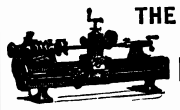


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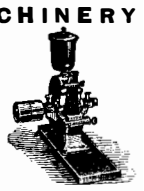
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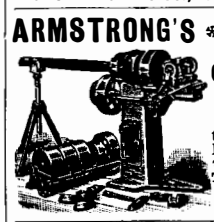
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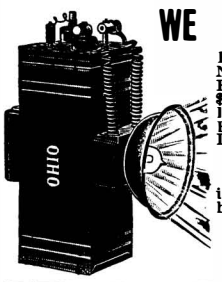
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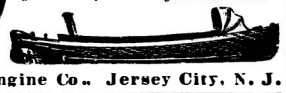
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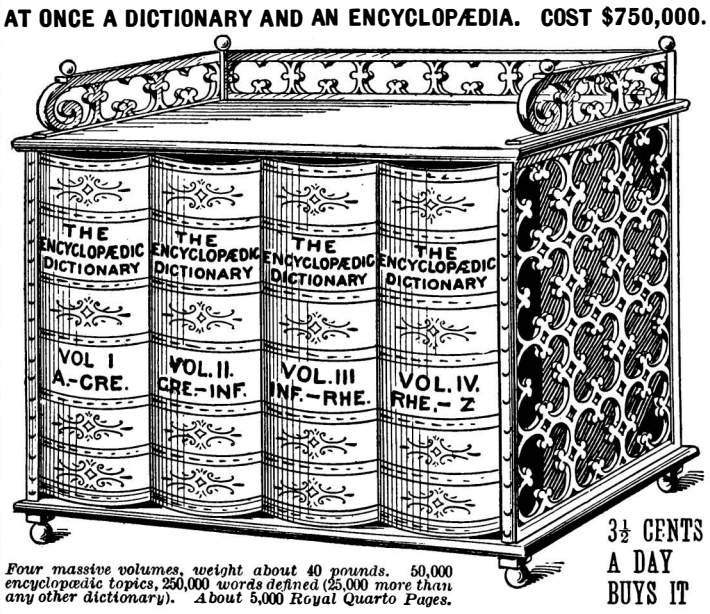
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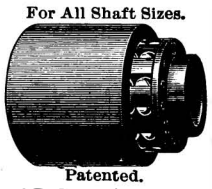
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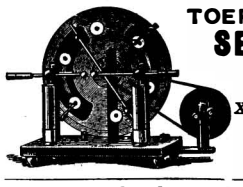
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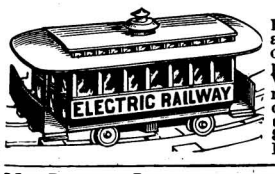
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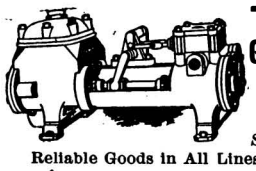
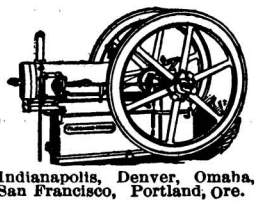
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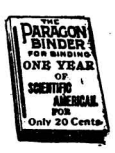
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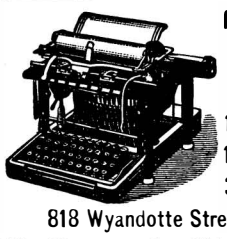
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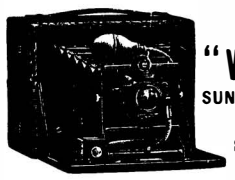


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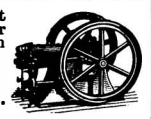
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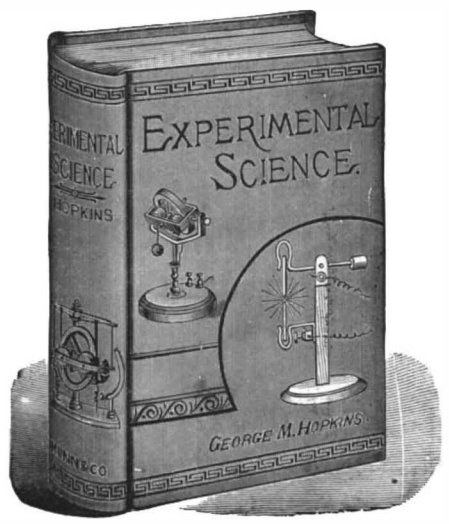
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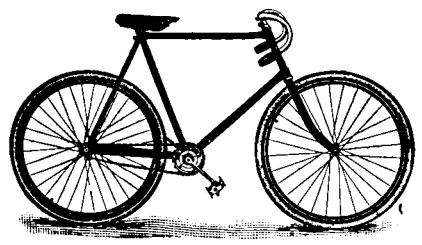
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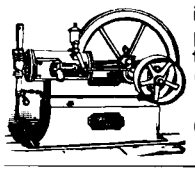
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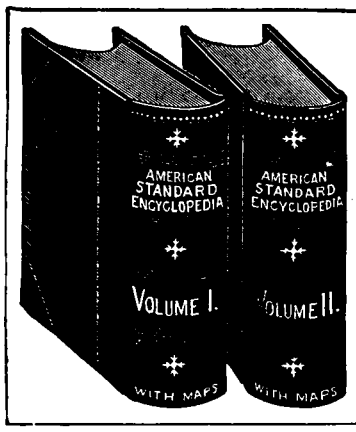
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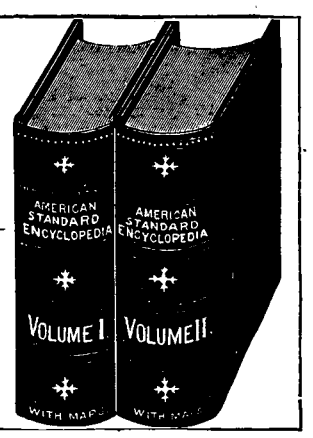
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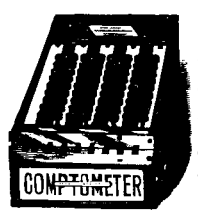
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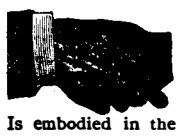
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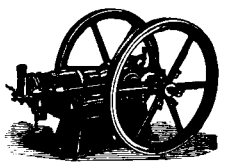


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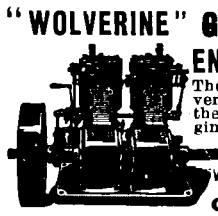
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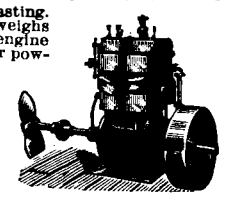
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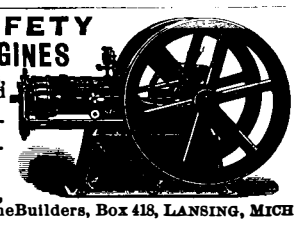
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